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Vol. 13, No. 6
March 31, 1988

Energy Research Abstracts

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ENERGY RESEARCH ABSTRACTS

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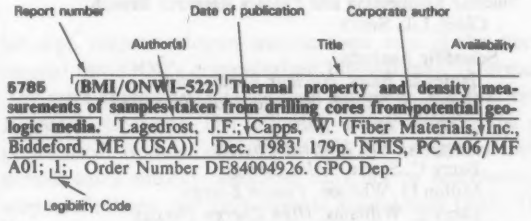
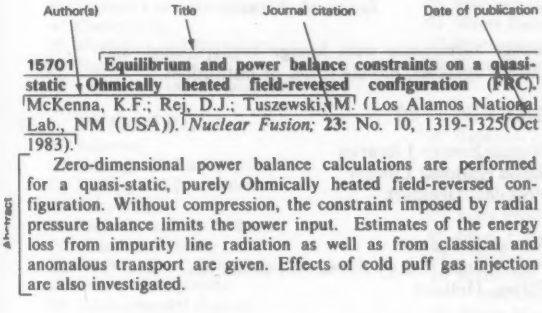
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; Order Number DE84004926. GPO Dep.

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.



15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23:** No. 10, 1319-1325 (Oct 1983).

Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

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Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
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• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
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Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
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Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. Order Number DE84004926, Distribution Category MN-70

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IEA Biomass Conversion Service
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IEA Coal Research
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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

0103 Preparation

REFER ALSO TO CITATION(S) 12635

10658 **(CONF-871030—10) Separation of coal macerals by magnetohydrostatic separation methods.** Dyrkacz, G.R.; Aznavoorian, P.; Young, J.; Neill, P.; Bloomquist, C.A.A.; Turner, L.R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 4p. NTIS, PC A02. Order Number DE88003030/JAW.

From International conference on coal science; Maastricht, Netherlands (26 Oct 1987).

In order to circumvent the batch nature of current density separations, methods are being sought that may provide continuous separation of macerals for larger scale separation. One possibility that has been explored is magnetohydrostatic separation or magnetic separation of the second kind. This type of separation is not the same as high gradient magnetic separation. In the latter case, material is separated based on the magnetic behavior of the individual particles placed in a magnetic field. In magnetohydrostatic separations (MHS), diamagnetic or very weak magnetic materials are separated in paramagnetic or ferrimagnetic solutions placed in a magnetic field. Although MHS has been examined for a variety of materials, it has not been used to separate coal macerals. The work described here represents our preliminary investigation of the potential of this method for coal maceral separation.

10659 **(DOE/FE—0095) Comprehensive report to Congress Clean Coal Technology Program: The Appalachian Project.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC). Dec 1987. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004630/JAW.

One of the Clean Coal Technologies selected projects was an advanced integrated gasification combined-cycle (IGCC) power generation plant proposed by the M.W. Kellog Company. By using an air-blown gasifier (which consumes less auxiliary power than an oxygen-blown system), hot gas cleanup, and an innovative tail gas treatment processing scheme, the concept provides higher thermal efficiency and superior environmental performance when compared to first-generation systems. This advanced approach will offer an excellent option for meeting future and potentially more stringent environmental emission constraints. Its standardized modular design and simple process configuration are also expected to yield signnificantly lower engineering and equipment costs while providing excellent flexibility in the capital expenditures required. The project will integrate a number of technologies fostered by DOE. Among these are the KRW Energy Systems, Inc. (KRW), fluidized-bed gasifier (development of which began at Waltz Mill, Pennsylvania, in 1972), in-bed desulfurization using limestone sorbent (demonstrated in 1985/86), and zinc ferrite sulfur removal in an external step (tested at pilot scale during 1986/87). The objective of the Appalachian Project is to demonstrate an efficient, economical, and environmentally superior method of generating electric power from coal. The work to be performed under the Cooperative Agreement includes the design, construction, and operation of the demonstration plant. Operation of the plant during the 2-year demonstration period will provide the information and experience needed for system commercialization.

10660 **(DOE/PC/72016—T1) Dewatering of ultrafine coal: Final report, August 1984-December 1986.** Chiang, Shiao-Hung; Klinzing, G.E.; Morsi, B.I.; Tierney, J.W.; Badgujar, M.; Binkley, T.; Cheng, Yisun; Huang, Suxuan; Qamar, I.; Venkatadri, R. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Dec 1986. Contract FG22-84PC72016. 139p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE87011194/JAW.

The surfactant, Aerosol-OT, was used to wash distilled water cakes. In previous studies, cakes were washed with Triton X-114. The dewatering performance and influence on cake structure of the two reagents are compared. Also, filter cakes were analyzed using an image analysis system and micrographic analysis of coal particles was initiated. In the area of theoretical modelling, the concept of bond-flow correlation greatly improved the network model predicting the experimental desaturation curves. Predicted results for treated cakes suggested that the effect of the presence of surface-active agents was adequately accounted for. The effects of the various operating conditions on the filtration/dewatering characteristics of the 10 μm coal particles were assessed and comparisons with the -32 mesh coal were made as to its trends in response to changes in the operating conditions. 20 refs., 75 figs., 17 tabs.

10661 **(DOE/PC/80519—8) Diffusion of gases in coals and chars: Quarterly technical progress report No. 8, June 15, 1987-September 14, 1987.** Smith, D.M. (New Mexico Univ., Albuquerque (USA). Powders and Granular Materials Lab.). 1987. Contract FG22-85PC80519. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003399/JAW.

As a result of the complex nature of coal, it is difficult to probe its pore structure over the entire pore size range of interest. Multiple techniques such as gas adsorption (nitrogen and carbon dioxide), mercury porosimetry, small angle x-ray scattering (SAXS) and density measurements are required. These techniques suffer from inherent problems such as a limited pore size range, errors due to network/percolation effects, the necessity of pore shape assumptions, and/or sample changes during analysis. In this work, the use of low-field NMR spin-lattice relaxation measurements as a pore structure analysis technique for coal is demonstrated. In principle, NMR pore structure analysis does not suffer from the problems of the other methods. Other measuring techniques investigated during the report period are: Surface area determination via nitrogen and carbon dioxide adsorption for raw coals; mercury porosimetry; and diffusion measurements.

10662 **(PB—88-103817/XAB) English-Russian, Russian-English glossary of coal-cleaning terms.** Pekar, J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). Sep 1987. 119p. (EPA—600/8-87/047). NTIS, PC A06/MF A01.

The document is an English-Russian, Russian-English glossary of coal-cleaning terms, compiled as a joint U.S./Soviet effort. The need for the glossary resulted from the growing number of language-specific terms used during information exchanges within the framework of the U.S./U.S.S.R. Working Group on Stationary Source Air Pollution Control Technology, under the U.S./U.S.S.R. Agreement of Cooperation in the Field of Environmental Protection.

10663 (PB—88-116678/XAB) **Artificial dewatering of peat. Part 2. The structure of Finnish peat and its influence on water retention. Research report.** Aho, M.; Laiho, R.; Tummavuori, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1987. 63p. (VTT/RR—494). NTIS, PC E04/MF A01.

The water-binding properties of peat were studied with six peat samples from two peat production areas in Finland. The samples represented the two main types of Finnish peat, Sphagnum and Carex. The degree of humification varied. The most important physical and chemical properties and the water-binding properties of the samples were measured and compared. Several different methods of analyzing peat were evaluated during the course of the study.

0104 Processing

REFER ALSO TO CITATION(S) 10717, 10773, 10898, 11157, 11165, 11392

10664 (AD-A—184846/4/XAB) **Production of jet fuels from coal-derived liquids. Volume 1. Market assessment for liquid by-products from the Great Plains Gasification Plant. Interim report, 20 January-30 April 1987.** Sinor, J.E. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Aug 1987. 227p. NTIS, PC A11/MF A01.

In September 1986, the Fuels Branch of the Aero Propulsion Laboratory at Wright-Patterson Air Force Base, Ohio commenced an investigation of the potential of production of jet fuel from the liquid by-product streams produced by the gasification of lignite at the Great Plains Gasification Plant in Buelah, North Dakota. Funding was provided to the Department of Energy (DOE) Pittsburgh Energy Technology Center (PETC) to administer the experimental portion of this effort. This report details the effort of JE Sinor Consultants, who, as a subcontractor to the DOE contract with the University of North Dakota Energy Research Center (UNDERC), determined the market potential of these by-product streams. This report describes the market potential of the by-product streams for the production of phenols, benzene, cresote, cresylic acids, coal tar pitch, paving materials, carbon black, naphthalene, rubber processing oils, as well as, jet fuels.

10665 (CONF-860425—44) **Refining coal liquids: Where we stand: Appendix 2.** Sullivan, R.F.; Frumkin, H.A. (Chevron Research Co., Richmond, CA (USA)). 1986. Contract AC22-76ET10532. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003130/JAW.

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

In extensive studies sponsored by the US Department of Energy, syncrudes from a variety of coals (bituminous, sub-bituminous, lignite) and several direct coal-liquefaction processes (SRC-II, H-Coal, EDS, ITSL) were catalytically hydroprocessed in pilot plant tests. The results show that these syncrudes can be refined to transportation fuels (diesel, jet fuel, gasoline) using commercial petroleum hydroprocessing technology. Key factors that determine how easy or difficult a particular syncrude is to refine are boiling range (endpoint), hydrogen content, and heteroatom content. This paper reviews experimental results, discusses alternative refining routes, compares projected costs for these routes with different feeds, and identifies areas in which further research is needed. 25 refs., 4 figs., 3 tabs.

10666 (CONF-871041—3) **Advanced research in instrumentation and control technology.** Raptis, A.C.; Sheen, S.H. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003047/JAW.

From Advanced research and technology development direct utilization; Morgantown, WV, USA (13 Oct 1987).

The primary objective of this project is to develop advanced instruments and measuring techniques to characterize and control multiphase media and process containing coal particles. The type of advanced instruments identified in the project is based on acoustic and ultrasonic techniques. The near-term objectives are to develop an ultrasonic viscometer and an acoustic imaging system for coal slurry.

10667 (CONF-871059—3) **Alloy performance in coal gasification environments.** Natesan, K. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002944/JAW.

From Materials for coal gasification; Cincinnati, OH, USA (10 Oct 1987).

Corrosion test data have been developed in simulated coal gasification atmospheres by using internally-cooled ring specimens of several commercial structural alloys. The roles of four key variables, namely, metal and gas temperatures, gas chemistry, and exposure time in the oxidation-sulfidation degradation of alloys were examined. In addition, the effect of gas temperature on the sulfidation of alloys was evaluated over the gas temperatures in the range 500 to 1040°C while maintaining a fixed sulfur partial pressure in the gas phase. Further, two specific experiments were conducted to evaluate the relative corrosion resistance of several metallic materials with and without downtime condensate formation. Metal recession data were obtained from the measurements of the scale thicknesses and depths of internal penetration; the results were used to assess the role(s) of several variables in the corrosion process and its impact on materials performance in the heat recovery units of coal gasification systems.

10668 (CONF-8703215—, pp 76-82) **Coal gasification in fluidized beds and pig iron baths - underground gasification of coal.** Gudenau, H.W.; Guntermann, K. 1987. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751240/JAW.

From 3. Aachen steel colloquium (ASC-3): manufacture of iron and steel and exhibition; Aachen, F.R. Germany (19 Mar 1987).

This is a report on further developments of the HTW process, particularly the fluidized-bed gasifier on the college laboratory scale on the effects of coal ash components or their distribution on the gas phase, slag and iron bath in iron bath gasification and on simulation experiments.

10669 (DOE/MC/21098—2247-Vol.1) **Summary and assessment of METC zinc ferrite hot coal gas desulfurization test program, final report: Volume 1.** Underkoffler, V.S. (Gilbert/Commonwealth, Inc., Reading, PA (USA)). Dec 1986. Contract AC21-84MC21098. 197p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE87001073/JAW.

The Morgantown Energy Technology Center (METC) has conducted a test program to develop a zinc ferrite-based high temperature desulfurization process which could be applied to fuel gas entering downstream components such as molten carbonate fuel cells or gas turbines. As a result of prior METC work with iron oxide and zinc oxide sorbents, zinc ferrite evolved as a candidate with the potential for high capacity, low equilibrium levels of H_2S, and structural stability after multiple regenerations. The program consisted of laboratory-scale testing with a two-inch diameter reactor and simulated fixed-bed gasifier gas; bench-scale testing with a six-inch diameter reactor and actual gas from the METC 42-inch fixed bed gasifier; as well as laboratory-scale testing of zinc ferrite with simulated fluidized bed gasifier gas. Optimum operating parameters for zinc ferrite such as temperatures, gas compositions, and space velocities are discussed. From the test results, salient features of zinc ferrite were derived and discussed in regard to system implications, issues raised, and technical requirements. 47 refs., 53 figs., 41 tabs.

10670 (DOE/MC/21098—2247-Vol.2) **Summary and assessment of METC zinc ferrite hot coal gas desulfurization test program, final report: Volume 2, Appendices.** Underkoffler, V.S. (Gilbert/Commonwealth, Inc., Reading, PA (USA)). Dec 1986. Contract AC21-84MC21098. 631p. NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE87001074/JAW.

The Morgantown Energy Technology Center (METC) has conducted a test program to develop a zinc ferrite-based high temperature desulfurization process which could be applied to fuel gas entering downstream components such as molten carbonate fuel cells or gas turbines. As a result of prior METC work with iron

oxide and zinc oxide sorbents, zinc ferrite evolved as a candidate with the potential for high capacity, low equilibrium levels of H_2S, and structural stability after multiple regenerations. The program consisted of laboratory-scale testing with a two-inch diameter reactor and simulated fixed-bed gasifier gas; bench-scale testing with a six-inch diameter reactor and actual gas from the METC 42-inch fixed bed gasifier; as well as laboratory-scale testing of zinc ferrite with simulated fluidized bed gasifier gas. Data from sidestream testing are presented. 18 refs.

10671 **(DOE/METC—87/4074) Surface acoustic wave deposition sensor.** Fasching, G.E.; Smith, N.S. (USDOE Morgantown Energy Technology Center, WV). Oct 1987. 21p. NTIS, PC A03. Order Number DE87006527/JAW.

The US Department of Energy's, Morgantown Energy Technology Center (METC) has studied the use of surface acoustic waves (SAWs) in instrumentation systems that monitor deposition level and rate of change in high-temperature, corrosive-atmosphere coal conversion and utilization systems. Such deposition monitoring systems are needed to design and maintain efficient coal conversion systems. This report reviews the development of the deposition sensor and the associated testing system from the first intrusively designed rectangular, stainless steel sensor to the current cylindrical, glass-ceramic, nonintrusively designed sensor. Tests in a laboratory deposition facility have shown that the latter design, after proper calibration, is capable of monitoring deposition up to the design maximum of 3.10×10^3 mg/m^2 (200 mg/in.^{2}) at room temperature. Changes from this calibration occur at higher temperatures. Tests at temperatures under 100°F above room temperature indicate that further work is needed to permit use of this deposition monitoring technique at elevated temperatures.

10672 **(DOE/METC—87/6079-Vol.1) Proceedings of the seventh annual gasification and gas stream cleanup systems contractors review meeting: Volume 1.** Ghate, M.R.; Markel, K.E. Jr.; Jarr, L.A.; Bossart, S.J. (eds.). (USDOE Morgantown Energy Technology Center, WV). Aug 1987. 371p. (CONF-870659—Vol.1). NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE87006495/JAW.

From 7. annual gasification systems conference; Morgantown, WV, USA (16 Jun 1987).

On June 16 through 19, 1987, METC sponsored the Seventh Annual Gasification and Gas Stream Cleanup Systems Contractors Review Meeting which was held at the Sheraton Lakeview Conference Center in Morgantown, West Virginia. The primary purpose of the meeting was threefold: to review the technical progress and current status of the gasification and gas stream cleanup projects sponsored by the Department of Energy; to foster technology exchange among participating researchers and other technical communities; to facilitate interactive dialogues which would identify research needs that would make coal-based gasification systems more attractive economically and environmentally. More than 310 representatives of Government, academia, industry, and foreign energy research organizations attended the 4-day meeting. Fifty-three papers and thirty poster displays were presented summarizing recent developments in the gasification and gas stream cleanup programs. Volume I covers information presented at sessions 1 through 4 on systems for the production of Co-products and industrial fuel gas, environmental projects, and components and materials. Individual papers have been processed for the Energy Data Base.

10673 **(DOE/METC—87/6079-Vol.2) Proceedings of the seventh annual gasification and gas stream cleanup systems contractors review meeting: Volume 2.** Ghate, M.R.; Markel, K.E. Jr.; Jarr, L.A.; Bossart, S.J. (eds.). (USDOE Morgantown Energy Technology Center, WV). Aug 1987. 433p. (CONF-870659—Vol.2). NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE87006496/JAW.

From 7. annual gasification systems conference; Morgantown, WV, USA (16 Jun 1987).

On June 16 through 19, 1987, METC sponsored the Seventh Annual Gasification and Gas Stream Cleanup Systems Contractors Review Meeting which was held at the Sheraton Lakeview Conference Center in Morgantown, West Virginia. The primary purpose of the meeting was threefold: to review the technical progress and current status of the gasification and gas stream cleanup projects sponsored by the Department of Energy; to foster technology exchange among participating researchers and other technical communities; to facilitate interactive dialogues which would identify research needs that would make coal-based gasification systems more attractive economically and environmentally. More than 310 representatives of Government, academia, industry, and foreign energy research organizations attended the 4-day meeting. Fifty-three papers and thirty poster displays were presented summarizing recent developments in the gasification and gas stream cleanup programs. Volume II covers papers presented at sessions 5 and 6 on system for the production of synthesis gas, and on system for the production of power. All papers have been processed for inclusion in the Energy Data Base.

10674 **(DOE/PC/70027—10) Hydrodynamics of Fischer-Tropsch synthesis in slurry bubble column reactors: Final report.** Bukur, D.B.; Daly, J.G.; Patel, S.A.; Raphael, M.L.; Tatterson, G.B. (Texas A and M Univ., College Station (USA)). Jun 1987. Contract AC22-84PC70027. 329p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE88000383/JAW.

This report describes studies on hydrodynamics of bubble columns for Fischer-Tropsch synthesis. These studies were carried out in columns of 0.051 m and 0.229 m in diameter and 3 m tall to determine effects of operating conditions (temperature and gas flow rate), distributor type (sintered metal plate and single and multihole perforated plates) and liquid media (paraffin and reactor waxes) on gas hold-up and bubble size distribution. In experiments with the Fischer-Tropsch (F-T) derived paraffin wax (FT-300) for temperatures between 230 and 280°C there is a range of gas velocities (transition region) where two values of gas hold-up (i.e., two flow regimes) are possible. Higher hold-ups were accompanied by the presence of foam ("foamy" regime) whereas lower values were obtained in the absence of foam ("slug flow" in the 0.051 m column, or "churn-turbulent" flow regime in the 0.229 m column). This type of behavior has been observed for the first time in a system with molten paraffin wax as the liquid medium. Several factors which have significant effect on foaming characteristics of this system were identified. Reactor waxes have much smaller tendency to foam and produce lower hold-ups due to the presence of larger bubbles. Finally, new correlations for prediction of the gas hold-up and the specific gas-liquid interfacial area were developed on the basis of results obtained in the present study. 49 refs., 99 figs., 19 tabs.

10675 (DOE/PC/79863—T5, pp 33-39) **Removal of chlorine from Illinois coal by high-temperature leaching.** Chen, Han Lin. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The objectives of this research are to: conduct experimental investigations of the removal of chlorine from coal by high-temperature leaching; identify important factors affecting the chlorine removal process; understand the mechanisms involved; and develop a mathematical model to describe the process. The experimental investigation has concentrated on the effect of chemical additives on the rate of chlorine removal. Both HNO_3 and NH_4OH were used as additives. In the case of HNO_3 addition, the rate increased significantly in the initial phase of leaching. After two hours leaching time, the percent of chlorine removal with HNO_3 addition was more than twice as much as those without addition. NH_4OH addition also improved the chlorine removal from coal, but to a lesser extent. The measurements of water penetration and surface area of each coal sample were continued. 2 figs., 2 tabs.

10676 (DOE/PC/79863—T5, pp 55-67) **Mechanism of extraction and desulfurization of coals with alcohols.** Muchmore, C.B.; Kent, A.C.; Smith, G.V.; Hinckley, C.C.; Phillips, J. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The objective of this research is to obtain a better understanding of the mechanism of desulfurization of coals with alcohols

under different processing conditions. Efforts have been directed at continued study of the mechanism of the participation of iron sulfides in coal desulfurization and the evaluation of the effect of mineral matter composition on removal of organic sulfur. Mixtures of ethanol in combination with small amounts of the radical initiators, O, NO, and NO_2, were reacted in the microbalance reactor with a specially cleaned coal which contained only 0.7% pyritic and 0.7% organic sulfur. Weight losses were substantially lower compared to weight losses with a higher sulfur coal treated in the same manner. Results suggest that the lower rate of weight loss is due to the very small amount of iron sulfide in the cleaned coal. Pyrite appears to serve in a carrier role after being reduced to the pyrrhotites and/or troilite by scavenging organic sulfur and then releasing it as H_2S using hydrogen atoms from the dehydrogenation of ethanol to acetaldehyde. Examination of the changes in concentration of major and trace elements in coals that occur during physical cleaning followed by treatment with nitric acid suggests that some elements, in particular iron, may play a catalytic role in the removal of organic sulfur when coal is reacted with alcohol. 9 figs., 3 tabs.

10677 **(DOE/PC/80012—T8) Biological production of fuels from coal-derived gases: Quarterly report, June 20, 1987-September 20, 1987.** (Arkansas Univ., Fayetteville (USA)). 1987. Contract AC22-85PC80012. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002518/JAW.

The technical feasibility of converting CO, H_2 and CO_2 from synthesis gas to ethanol and acetate has been demonstrated in a continuous stirred-tank reactor with both continuous gas and liquid feed. This report describes the equipment and procedures for continuous operation, as well as steady-state experiments carried out at three steady-state conditions. Although the operating conditions for continuous operation have not been optimized and a significant amount of acetate remains in the product stream, the feasibility of using a bacterial process for synthesis gas conversion to liquid fuels has been demonstrated. Future work during subsequent contracts should concentrate on producing a single liquid fuel as a product, increasing the product concentration, and defining and optimizing reaction conditions for maximizing, product yield. 3 refs., 17 figs.

10678 **(DOE/PC/80516—9) Control of catalyst deactivation with ammonia: Quarterly report for period, September 1, 1987 to November 30, 1987.** Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1987. Contract FG22-85PC80516. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003679/JAW.

Catalysts are readily deactivated by adsorption of nitrogen compounds. We have now found that the poisoning effect of nonsterically hindered nitrogen compounds, expressed as inhibition adsorption constants derived from Langmuir-Hinshelwood kinetics for thiophene hydrodesulfurization, correlates well with gas phase basicity (proton affinity). The order of adsorption strength agrees generally with that reported for poisoning of hydroprocessing catalysts and of acidic cracking catalysts. Inhibitor adsorption constants from thiophene HDS studies correlate well with measurements of inhibition of the hydrodeoxygenation of dibenzofuran, even when the N-compound undergo considerable reaction and it is necessary to account for the inhibiting effects of reaction intermediates. Studies were on $NiMo/Al_2O_3$ catalyst at 7.0 MPa and 300 to 400°C. 33 refs., 14 figs., 2 tabs.

10679 **(LBL—24268) Steam gasification of carbon solids catalyzed by a nickel-potassium mixed oxide: Kinetic and surface characterization studies.** Carrazza Duca, J. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 206p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88003857/JAW.

The main goal of this thesis is to evaluate and understand the catalytic properties of a nickel-potassium mixture for steam gasification of carbon solids. This goal pursued by carrying out kinetic and surface characterization studies, using both graphite and a coal-char as carbon substrates. The kinetic study on graphite gasification shows that the nickel-potassium mixture has distinct catalytic properties for this reaction, when compared with potassium-alone and nickel-alone catalysts. The mixture is active at relatively low temperatures (800 K) compared with the potassium-alone catalyst, and does not deactivate with time, contrary to the case of nickel alone. These properties are attributed to a cooperative effect between nickel and potassium. The performance of the nickel-potassium catalyst in a process of technological interest, such as the steam gasification of coal-chars, was also investigated. The results indicate that the mixture is a better catalyst for steam gasification of low ash chars, than both nickel-alone and potassium-alone catalysts. A temperature programmed desorption and X-ray photoelectron spectroscopy study on the adsorption of O_2, H_2O, CO and CO_2 on clean graphite is also presented. It is proposed that all four gases form the same type of oxygen containing surface species, after chemisorption. The most abundant surface species desorbs as CO between 1000 and 1300 K, and has been assigned to a semi-quinone functional group. This CO precursor can react with the adsorbing gas, and form a second species, that desorbs as CO_2 between 500 and 900 K. A surface lactone has been proposed as the CO_2 surface precursor.

10680 **(NEDOJ—501, pp 7-14) Development of bituminous coal liquefaction. Study on optimum process using 2.4t/d plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an Annual Report covering FY 1984 of the NEDOL Coal Liquefaction Process Development Project using bituminous coal as feedstock. Using a 2.4t/d plant during FY 1982, three coal liquefaction experiments (RUN 100, 200 and 300) were carried out. These tests were succeeded by two liquefaction operations (RUN 400, 500) in FY 1983. The principal objectives were to obtain necessary engineering data for the design and operation of a 250t/d pilot plant by carrying out liquefaction characteristics improvement tests according to equilibrium solvent circulation operation. In FY 1984, three runs (RUN 600, RUN 650, RUN 700) were carried out. Using Taiheiyo Coal, red mud + sulfur catalyst, synthetic iron catalyst, the total system circulation operation time was 89 hours, with high temp. sustained for 195 hours, 374 hours. Respectively in RUN 700, Taiheiyo coal and synthetic iron catalyst and temp. control, the adhesion of iron sulfide in piping on the previous occasion was eliminated and increase in pressure loss in the high pressure gas system was suppressed and continuous operation was possible by washing the piping while maintaining high pressure. (1 tab)

10681 **(NEDOJ—501, pp 15-19) Development of bituminous coal liquefaction. Study on optimum proces using 1t/d plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an Annual Report covering FY 1984 of the NEDOL Coal Liquefaction Process Development Project using bituminous coal as feedstock. This is a series of coal liquefaction experiments since FY 1980 in which a 1t/d plant is used. The principal objective of this study is to demonstrate efficient liquefaction process, improve apparatus performance and to acquire higher level of techniques. In 1984, 4 runs were carried out as demonstration test and total operation time was 1,123 hours. As a result, liquid yield was about 46% (daf). Paraffin in liquid showed a tendency to increase but the aromatic carbon in liquid tended to decrease. In the high pressure parts no new SCC or pitting holes as observed last year were noted. (1 tab)

10682 **(NEDOJ—501, pp 20-22) Development of bituminous coal liquefaction. Study on optimum process using 1 t/d plant and small-sized continuous apparatus .** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is Annual Report covering FY 1984 of the NEDOL Coal Liquefaction Process Development Project using bituminous coal. This is a series of coal liquefaction experiments since FY 1980. The principal objective of this study is to contrive to provide feedback on operation conditions, etc., on the 1t/d plant as well as to improve the process. Using a continuous liquefaction system (4 lit/h BSU), continuous hydrogenation system (2 lit/h BSU), batch type reactor, the NEDOL process operation was carried out. The effects of increasing the number of reaction tower of the continuous liquefaction system from one to two towers, under standard liquefaction

conditions (450'C, 150 kg/cm²G, 1 h, CGS catalyst), liquid yield showed about 2% increase without short-pass occurring in single batch complete mixing bath. Together with the increase in gas amount/slurry flow rate in the liquefaction conditions, increase in liquid yield and making the liquefaction oil light were possible.

10683 (NEDOJ—501, pp 23-27) **Development of bituminous coal liquefaction. Study on deashing technology using 1 t/d plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is Annual Report covering FY 1984 of the NEDOL Coal Liquefaction Process Development Project using bituminous coal. This is a series of experiments since 1978 FY. The principal objective of this study was to develop optimum pretreatment techniques of coal for liquefaction, to enhance liquefaction economics by reducing wear of valve, pipings, etc., and to increase liquid yield. In the specific gravity separation method using Australian Wandoan coal, deashing and simultaneous concentration of active liquefying components were hydrogen consumption increased. Also liquid yield of clean uncrushed coal was greatly increased by pulverizing. On the other hand, with the underwater granulation method, deashability and recovery rate of clean coal were excellent, drastically reducing cost of additive oil but the liquid yield did not very much with that of the raw coal. (1 tab, 5 figs)

10684 (NEDOJ—501, pp 28-37) **Development of bituminous coal liquefaction. Study on liquefaction condition using small-sized apparatus.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an Annual Report covering FY 1984 of the NEDOL Coal Liquefaction Process Development Project using bituminous coal. From FY 1978, as an item of Sunshine Project, the project has been continued for development and research of a Direct Coal Hydrogenation Liquefaction Plant. The principal objective of this study is to support PDU Test Plant's operation, to select the kind of coal, to obtain operation conditions, properties, material balance for the said purpose, as well as basic data for efficient and economic process flow establishment, and to acquire technical references necessary for the design, fabrication and operation of a large-sized pilot plant. Using a 0.1t/d continuous coal liquefaction apparatus, the following results were attained: (1) Preheating reaction process reduces comsumption of hydrogen. (2) The quantity of catalyst proved best at 3 wt%. (3) The Wandoan Coal produced in Australia was advantageous in liquefaction over the 3 Canadian brands. (4) The total yield and naphtha distillate did not vary even when the retention time exceeds 0.67 hr-1/kg. (1 tab, 4 figs)

10685 (NEDOJ—501, pp 38-42) **Development of bituminous coal liquefaction. Study on catalyst for coal liquefaction.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was performed as studies consigned by NEDO. Conditions on applications of catalyst were studied by performing an ability test with autoclave and continuous ability test facility, and by operating catalyst production facility. Hitherto studies using ferrous catalyst and study on separation and reuse of catalyst has been performed, and this time these previous research themes were consolidated as a study on coal liquefaction catalyst, and the supply and operation for 4 t/day PDU and separation and recovery tests using liquefaction product oil were performed. As a catalyst for PDU, fine particle catalyst under several micron and artificial particle type catalyst (5-50 micron) was produced for trial. PDU tests were carried out under the following conditions: coal: coal produced at Taiheiyo Mine, Medium oil: hydrogenated and denitrated anthracene oil, temperature: 420°C - 450°C, pressure: 250kg/cm² stay time: 1.2 hr. catalyst addition: 5 wt.%/coal. And as a result, by comparing the conditioned catalyst with red mud, it was found that the conditioned catalyst had smaller amount of distilled residue on liquefaction products than that of red mud. And by studying the cost of catalyst, a new dry process capable of using low cost raw materials was discovered.

10686 (NEDOJ—501, pp 43-48) **Development of bituminous coal liquefaction. Study on catalyst for solvent hydrogenation.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This study was performed as research consigned by NEDO. The study was to obtain distillated as liquefaction products and a recycle solvent with high capacity for hydrogenation by hydrogenating middle and heavy oil distillated. And a range of boiling point, 200 °C - 538°C was selected for a catalyst of Ni- Mo / Aluminum series for hydrogenation process to be applied to liquefaction oil distillates. This catalyst was proved to have no problems on durability through a long term continuous test of 560 hrs. Using this catalyst, relation between reaction condition and degree of hydrogenation of solvent, rate of decomposition of heavy oil distillates and hydrogen consumption were examined. And basic data were obtained on effects of HVGO concentration in the high boiling point solvent in catalytic actions, thereby giving a guide for the operation of 1 t/d PDU. Twenty varieties of catalyst mainly of zeolite series were manufactured for trials, and it was found that there is a catalyst of zeolite series (C-59-16) having more activity for paraffinic decomposition than Ni-Mo / aluminum series (C-56-02). (2 figs, 2 tabs)

10687 (NEDOJ—501, pp 49-58) **Development of bituminous coal liquefaction. Study on reactor for solvent hydrogenation.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This study was performed as a research work consigned by NEDO and it is intended to optimize various stages to establish a bituminous coal liquefaction process. And on coal capital of obtaining high efficiency for hydrogen utilization, bituminous coals of U.S Eastern States with high N and S component were selected and operation of a pilot plant was performed to demonstrate the process. Namely, by means of once-through operation, liquefied oil to be used for recycling in the subsequent operation was obtained as well as data on reacting characteristic for 1 ton/day short time liquefaction plant. While the Indiana V coal has a higher degree of carbonization than that of Wandoan coal, it has a smaller amount of gas generation with some moisture. As a result of the once-through operation, it was found that at a rate of hydrogen consumption of 4.7 wt.%, an oil yield of 50.4 wt.% was obtainable. Further, by introducing a reaction model in which a liquefaction test data is reflected using the liquefaction solvent with a poor hydrogen supplying characteristic for the first stage of the reaction, accuracy of estimation on the change in the character of liquefied oil was found to be improved, and by examining technologies available for the correction of models to incorporate various test results, a bright prospect was obtained leading to a process simulator with a good potential for expansion. It was also found that an upgrading oil better in quality than that from Wandoan coal should be obtainable when the Indiana V coal was used for raw material. (3 tabs)

10688 (NEDOJ—501, pp 59-62) **Development of bituminous coal liquefaction. Conceptional design of a pilot plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This study was performed as research work consigned by NEDO. In order to obtain a tangible guide for the basic design of pilot plant for bituminous coal liquefaction, a survey was carried out on process, main plant machinery, installation and plant operation. And the recent data were recapitulated and a standard design criteria was laid down. And on preparatory treatment of coal, a dry and wet combined system was planned giving weight to dry pulverization, and selection of machinery type, system organization, countermeasures to meet fluctuation with in a range of plant operation were studied. On liquefaction plant facility, plan and design of preliminary slurry heater and liquefaction reactor were studied, and reorganizing these studies, an outline diagram covering design specifications of the reactor was prepared. The plan on solvent hydrogenating facility has the following capacity and operating condition; amount of solvent feed : 17,000 kg/hr, degree of hydrogenation, (fa): 0.10, pressure: 100 kg/ cm²G, average temperature: about 330°C at SOR, about 360°C at FOR, H purity of circulating

gas: above 95 mole%, inlet gas/solvent ratio: 0.5 Nm/kg. And based on such specifications on the facility, design specifications and conceptual drawings were prepared for normal pressure distilling columun, naphtha recovery / distilling columun and pressure reducing distilling columun, and tangible results were obtained including process flow diagram, material balance.

10089 (NEDOJ—501, pp 63-68) **Development of bituminous coal liquefaction. Basic and detailed design of a pilot plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This study was performed as a research consigned by NEDO. In order to complete a basic and detailed design results obtained by a conceptual design of a pilot plant and by a process development unit subjects of study were consolidated according to itemized studies covering design, construction and operation of the pilot plant, and a part of the basic design was started from liquefaction process as a center of the system. And first, design of pilot plant, systematization of solutions on research and developmental themes, determinations of design phylosophy and project schedule were worked out. A master pilot plant was prepared so as to arrange the whole plant in a site of 400m X 400m. And site condition were surveyed covering availability of utilities, accommodation to receive coal, drainage, waste disposal.

10090 (NEDOJ—501, pp 69-85) **Development of brown coal liquefaction. Study on optimum liquefaction process.** Aug 1985. NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

As to the research of 50t/d pilot plant for the development of liquefaction pilot plant of Victorian brown coal in Australia, general descriptions of the result as for studies of the following 5 items have been done from 1983 April to 1984 March, and are reported here. 1: primary hydrogenating technology describes 7 items. 2: deashing technology describes 3 items. 3: secondary liquefying technique describes 4 items. 4: dehydration technology for raw brown coal describes the effects of the viscosity of raw brown coal slurry before dehydration in CLB bottom cycle and physical property of solvent for raw brown coal. 5: catalyst for liquefaction describes (1) basis as for primary hydrogenation, (2) basis as for secondary hydrogenation, (3) analysis as for liquefaction reaction. (12 figs, 1 tab)

10091 (NEDOJ—501, pp 86-95) **Development of brown coal liquefaction. Design, construction and operation of a 50 t/d pilot plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

As for the development of 50t/d pilot plant for the development of liquefaction plant of Victorian brown coal in Australia, outline of the results of the researches in 1984 is reported from the following 4 viewpoints; 1: design of process apparatuses, 2: manufacture of apparatuses, 3: field work of the construction, 4: preparation for operation of the plant. On the first item, the outline of ordering designed equipment from Japanese and Australian companies is described. On the second item the acceptance of purchasing goods from Japan and Australia and promotion of the inspection and quality assurance system. On the third item, contents of the continuous construction of the first stage are described. On the fourth item, the establishment and review of rules and regulations, training and education for operators, enviromental assessment, contents of safety and maintenance work and commissioning work by the promoting department for preparation of operation are described. Moreover support works of wide range for the promotion and adoption by necessary personnel, labour unions, the state of labour and activities for local discricts are described.

10092 (NEDOJ—501, pp 96-100) **Development of reactor materials for coal liquefaction plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the annual report of FY 1984 as for the developments of the materials for large reactors necessary for the pratical operation of the coal liquefaction processes. In order to develop materials used for a long time in the environment of hydrogen gas at high temperature and high pressure and to prove their safety, the following evaluation researches have been done. 1: Evaluation of design criteria; The test data of long time creep of test pieces of the forged shell with large thickniss manufactured for trial in FY 1981-1982 and fracture by creep test have been collected for 21 thousands hours. As for these materials, the strength for creep fracture was about 50 percent higher than existing Cr-Mo steels and embrittlement phenomenon by creep was not observed up to the high temperature range of 550°C. 2: Evaluation of resistance to hydrogen attack. (1) Evaluation of resistance to hydrogen corrosion. As for developed material with added V-Ti-B, long time hydrogen corrosion test has been done and data for more than 10,000 hours are accumulated and excellent resistance was proved. (2) Evaluation of the sensitivity for cracking by absorbed hydrogen. Stress expanding coefficient for the limit generating cracks has been evaluated and excellent resistance was proven. (3) Evaluation for separation resistance to hydrogen brittlement on the overlayed part of stainless steel. Very high resistance have been proved by the evaluation test in experimental room simulated to the operating condition of the actual plant. 3: Promotion for regulating material and design basis. (4 figs)

10093 (NEDOJ—501, pp 101-104) **Development and manufacture of equipment for coal liquefaction plant. Study of corrosion resistance.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the annual report of FY 1984 as for the developments of the materials for the local parts of varios equipments in the coal liquefaction plant. In order to analyze corrosion process under environment and select proper materials and make use of them for plant design, the following tests have been done. 1: In-plant material test in 1 t/d experimental plant. The test pieces inserted in FY 1983-1984 were taken out from plants and examined and the states of corrosion of the each part of materials have been recognized. SS 41 steel and Cr-Mo steel corrode greatly even in low temperature parts and the corrosion of stainless steel is generally slight. Also as for test pieces taken from plant piping, corrosion state was examined but remarkable defects were not found. Moreover ultrasonic flaw detection method for welded parts of vessels was investigated and proper flaw detecting method was established. 2: Basic test for corrosion resistance in liquefied slurry and produced gases. Corrosion test of 1000 hours, that simulated the condition of liquefaction reaction system, was done, and it is found that the corrosion resistance under the environment of high temperature H S-Cl is proportional to the contained Cr. It is found that the effect of Cl ion is small. but corrosion resistivity depends upon the quantity of Cr basically.

10094 (NEDOJ—501, pp 105-108) **Development and manufacture of equipment for coal liquefaction plant. Study by in-plant test for auxiliary equipment.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report of FY 1984 as for the developments of the materials for the various high pressure valves and the high pressure and high temperature piping in the coal liquefaction plant. With use of experimental plant, the following in-plant test for corrosion, erosion and wear. 1: Test for high pressure slurry valves. As for the continuous high temperature, let down valves that the basic type of shape is the one used in H-coal plant, and that the material is tungsten-carbide, and that the sheet and the outer surface of plug-guide is coated with Ti-N, tests were done chiefly, and continuous operation of 201 hours is recognized to be possible. 2: Test for high pressure slurry check valve. Tests of 3 kinds were done on different materials of balls and seats and tests of measurement of dimention, weight and surface roughness, sphericity and circularity and appearance inspection were done. And it is determined that the combination of ball of SUS 400C and seat of stellite are better. 3: Test for high pressure slurry piping. Test pieces with various inner diameters and U bend of various radius of curvature were tested for remarkable wear. In-plant test pieces for detecting the state of corrosion have been manufactured and various data have been obtained at checks and repairs of the plant.

10695 (NEDOJ—501, pp 109-113) **Development and manufacture of equipment and machinery for coal liquefaction plant. Development of hydro-hoist.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on the test run and the real test of the reliability test equipment constructed in 1983 as an experimental manufacture of hydro-hoist for feeding material in large scale reactor for NEDO method Coal Liquefaction Process (NEDOL Process). The specifications for the element machinery and equipment including 30m³/hr for a flow rate of the hydro-hoist and 250kg/cm² for discharge pressure have been set up so as to cope with the planned capacity of the 250t/d pilot plant. The research results obtained are as follows: 1. The element machinery and equipment (feeding chamber, flow, high pressure slurry valve) can stand for 2,300 hr operation with pressure cycling of 0 to 250kg/cm². 2. Pressure rise of the equalizing plunger can be performed in a short time of 0.3 to 0.4 sec. 3. The high pressure slurry valve improved from conventional vertical type to the horizontal type is workable. 4. The proximity switch is capable of detecting the float even under a high pressure of 250 kg/cm². 5. Pipelines in which no material is flowing always, particularly small diameter pipelines, clog unless they are warmed with a heater and the like. 6. It is necessary to carry out further tests on the durability of the flow after ajusting the specific weight of flow and separating coal particle mixed in the driving liquid. (2 figs, 1 tab)

10696 (NEDOJ—501, pp 114-116) **Development and manufacture of equipment and machinery for coal liquefaction plant. Development of centrifugal slurry pump.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on the research conducted since 1982 for the purpose of developing a centrifugal slurry pump to be used for coal slurry transport in the coal liquefaction plant. The research aims at confirming practicability of the centrifugal slurry pump for the liquefaction plant through conducting various tests utilizing test pumps and test equipment. The details of the research are as follows: Firstly, as a preliminary test, a performance test using fresh water and high temperature test using 200°C test water on the test pump were effected, then a performance test with coal/water slurry was effected over the total driving time of 1,000 hr, so that the abrasion property was confirmed. As a result, it was clarifird from the result of the performance test using fresh water that the slurry pump shows lower performance compared to the ordinary pump; however, also it was clarified from the result of the high temperature driving test that the slurry pump has no functional problem even with the present pump structure and material. Furthermore, from the performance test with coal/water slurry, the flow rate of the pump with the slurry coincided with the max. efficiency point in the Vicadle formula as originally expected. Slight erosion was recognized at runners, volute vanes, wear rings, etc. However, it was confirmed that the abrasion by slurry is very small. (1 fig)

10697 (NEDOJ—501, pp 118-120) **Investigation of coals for coal liquefaction.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a part of an annual report for 1984 on the research including investigation of resource, and liquefaction property, which are to be utilized for selection of coal for liquefaction. 1. Investigation of coal property; Various chemical analysis and physical tests were coducted on bituminous coal, subbituminous coal and brown coal produced in Canada and comprising 12 kinds and 41 samples. Also, analysis of coal texture and measurement of reflection ratio were effected so as to obtain more detailed property of coal. 2. Test for evaluating liquefaction property; Following the test conducted in 1983, the evaluation test of liquefaction property was carried out on Australian coal including 4 kinds and 4 samples, and Canadian coal including 12 kinds and 41 samples. The liquefaction test was made with a stainless steel 500ml shaking autoclave under the standard conditions. 3. Simplified test for evaluating liquefaction property; Execution of the evaluation of the coal by evaluating liquefaction property requires a large number of sample tests. In order to cope with the requirement, investigation and examination were made on equipments and method for the simplified test. After obtaining the data on the coal property and the liquefaction property through above investigation, correlation between both properties are examined and based thereon the coal liquefaction potential possessed by coal from specific coal fields and coal mines are evaluated for selection of coal.

10698 (NEDOJ—501, pp 121-122) **Investigation of coals for coal liquefaction. Study on Chinese coals.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

An annual report for 1984 on the research since 1980 aiming at conducting liquefaction tests on Chinese coal mainly in China and obtaining data on liquefaction property so as to select coals for liquefaction. A small continous test equipment which had been completed in 1982 in Beijin was used for the test to obtain data on the liquefaction property of 4 kinds of Chinese coal. The test was conducted with the standard condition including reaction temperature of 450°C, reaction pressure of 250kg/cm²G and residence time of 60 min, while reaction temperature and residence time were varied to obtain data on basic liquefaction property of each kind of coal. Moreover, as it had been made clear from the test results in 1983 that increase in hydrogen injection has an effect on increasing conversion ratio and oil yield and decreasing asphaltene, the circulation of generated gas was added to increase hydrogen amount in the reactor and modification of the equipment for safety operation of the equipment and improving safety wae introduced.

10699 (NEDOJ—501, pp 123-133) **Technology of refining coal liquids and uses of its products.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

An annual report for 1984 on the refining technology of liquid fuel in Japan, refining technology of coal liquefaction, for which the refining technology of liquid fuel finds greatest adaptability, and development of application technology of coal liquid products. A 100cc hydrogenation microreactor which had been designed and constructed for the research on upgrading of coal liquefied oil was applied as the experimental equipment. The outline of results is as follows: 1. Upgrading by fractions; An experiment of hydrogenation and refining on the microreactor was conducted with naphtha fraction and kerosene fraction to make evaluation of the property of refined oil and investigation on the optimum operation condition of the plant. Moreover mixing property of crude liquefaction oil and safety of its storage were investigated. 2. Collective upgrading of middle fractions; Design and construction of two microreactors were executed to investigate the condition for hydrogen refining of liquefied oil and the lifetime of catalysts. Furthermore, analyses of liquefied oil were carried out to evaluateit as fuel oil. (6 figs, 8 tabs)

10700 (NEDOJ—501, pp 134-141) **Development of application of estimation method for the coal liquefaction process. Development of liquefaction process simulator.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the FY 1985 annual report covering the NEDOL coal liquefaction process development project. In order to quantitatively study the coal liquefaction process, and its unit process a simulator was developed and tested. 1) System analysis for establishment of evaluation methods; Development of model for complex tower distillation calculation, study of liquefaction characteristics based on liquefaction reaction model, comparative study with solvent hydrogenation experiment data, were carried out. And further, study of feed stock properties and recovery rates, solvent circulation systems, hydrogen circulation systems and middle oil mixing system were executed. Thereby, characteristics of processes were grasped. 2) Development of software for liquefaction process simulator; Consistency of the system was verified and simulator test and users' manual were prepared and the liquefaction simulator was installed. (2 tabs)

10701 (NEDOJ—501, pp 142-147) **Development of environmental protection technology. Development of coal liquefaction waste water treatment.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the 1985 Annual Report on the NEDOL method coal liquefaction development project. The wastewater treatment test equipment was operated and the ideal way of wastewater treatment system was studied. 1) Investigation of the total system of wastewater treatment of the liquefaction plant; Inorder to investigate the water quality of simulated wastewater, experiments were carried out to obtain estimation of the quality of the overall wastewater and the oil/water distribution coefficient of phenols and the dispersion coefficient was determined. Also, as a study of conventional liquefaction wastewater treatment systems, general design and construction of the wastewater system was carried out and quantity of wastewater treated was calculated with economic factor elucidated. 2) Development of high efficiency wastewater treatment unit operation. Quality of wastewater, ammonia stripping, phenol removal by impregnation type liquid membrane extraction process, elimination of organic substances by anaerobic fluidized bed, post-treatment by biofiltering, concentration process by reverse osmosis membrane, catalyst type wet oxidation, were respectively carried out and satisfactory results attained. (2 tabs)

10702 (NEDOJ—501, pp 148-150) **Development of environmental protection technology. Environmental safety test of coal liquefied oil.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 Annual Report.

This is the 1985 FY annual report on NEDOL coal liquefaction process development project using bituminous coal as feedstock. In order to establish labor sanitation and social receptiveness in relation with coal liquefaction, as phase I (FY 1984-1985) with light oil, middle oil and heavy oil as objectives, various tests were carried out in accordance with applicable stipulations and items of the Law related to screening and restrictions in the production, etc.,of chemical substances, and Labor Safety and Sanitation Law. Tests entailed acute toxicity (oral, inhalation), primary dermal irritation, primary eye irritation, dermal phototoxicity, dermal sensitization, repetitive skin application, primary modification (Ames), acute fish toxicity. (2 tabs)

10703 (NEDOJ—501, pp 151-157) **Development of technology for coal gasification. Study on high-calorific gas production,using 7000 Nm³/d plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In order to develop a 7000 Nm³/d high calorie gasification plant with the fluidized bed method, operational studies have been carried out for enhancing economics of the plant and diversifying raw materials. The test, with the primary objective of improving efficiency by reducing the quantity of steam and continuous safe operation, was carried out under the pressure of 30Kg/Cm². As a result, the operation target of the plant comprising 70% gasification efficiency and 300 hours continuous operation were attained. Furthermore, the plant was operated 5 times during the current year for an aggregate 886 hours.(1 fig, 1 tab)

10704 (NEDOJ—501, pp 158-159) **Development of technology for coal gasification. Study of pressurized-fluidized gasification system using small scale apparatus.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This report covers the Coal Liquefaction Process Development Project for Fiscal Year 1985. Research was carried out to obtain basic data demonstrating attainment of high efficiency at time of diversifying feed stock in the 7000 Nm³/d plant gasifier and attaining efficiency enhancing conditions in decreasing vaporization and in increasing gasification temperature. 1) Study of high efficiency gasification of imported coals; Using an internal-combustion type low pressure gasification apparatus, the characteristics of Chinese coals were investigated; thereupon, guidelines for selection of test conditions and technical perspectives have been attained. 2) Supporting study for 7000Nm³/d plant gasification efficiency showed 71.5%, which exceeded the target value 70%. Also, stable continuous operation of 300 hours was achieved.

10705 (NEDOJ—501, pp 160-164) **Development of technology for coal gasification. Development of technology for multi-purpose high temperature gasification, using small scale apparatus.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is FY 1984 annual report concerning development of technology for multipurpose high temperature coal gbsification. Gasification method is entrained bed type. Produced gas will be used for production of synthesis gas and hydrogen. In order to develop essential technology for gasification, research was promoted with results attained as follows: 1) Shape of gasifier: Based on a cold model,varying the furnace height and revolving circle of the burner, etc.,the particle suspension time and particle locus were checked. Thereby it was learned that the particle down-flow zone in the gasefier became saturated at a certain height and that the higher the furnace within this range the better. 2) Feeding system: Using a coal feed testing device comprised of a coal hopper, feeder, conveyor pipe, distributor, etc., studies were made concerning stable conveying conditions and uniform distribution conditions, and a formula relative to conveying state in the conveyor pipe was derived. 3) Stable down-flow of slag: Using a slag down-flow testing device, flowing conditions of coal were checked repeatedly and it was elicited that to ensure stable down-flow the temperature of the slag tap hole should be maintained at a temperature close to or more than the pour point of the ash. 4) Coal burner: Coal burner testing apparatus was designed and fabricated and tests were carried out regarding the selected multinozzle revolving type and collision type and the initial gasification efficiency was higher with the latter type.

10706 (NEDOJ—501, pp 165-172) **Development of technology for coal gasification (high-calorific gas). Feasibility study of large scale gasification plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This report covers the subject research project using coal and heavy oil as raw stock for the FY 1984. Based on results of studies up to the 1983 FY, a conceptual design was carried out on an assumed site selected. 1) Site survey: Based on specification of plant under planning, 8 gas companies from a total of 248 companies in Japan, capable of utilizing 70% or more of the gas production rate of 350,000 Nm³/d were initially selected. Next, a single optimum site which can realize an average working ratio of 91%, omitting regular repairing period of 2 months, was selected, taking into consideration introduction plans for LNG, surrounding conditions such as port facilities, adaptablity to gas properties and future prospects. 2) Conceptual design: Based on the foregoing concrete site conditions and results of feasibility studies of FY 1983 and operation data on 7000 Nm³/d of 1982-1984 FY, a trial balance was calculated on anticipated performance of a large scale 350,000Nm³/d plant, utilities consumption rate and gas production cost. Also a study and evaluation of economics was performed. As a result of trial calculations the total site area of the plant was expected to be about 140,000m² with construction costs of 45.4 billion yen. (1 tab, 71 refs)

10707 (NEDOJ—501, pp 173-185) **Development and manufacture of equipments for coal gasification plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Basing on investigations and researches having been continued since 1980 to make clear the possibility of several existing materials for use as material for coal gasification plant, and to obtain new materials, corrosion tests on such materials at high temperature under high pressure in the atmosphere of coal gasifier were executed together with powder erosion test and practical furnace test in 7000 Nm₃/d Iwaki gasification plant. The corrosion tests for the existing materials and developed materials were done at 700-850°C, 30 atg. in simulated coal gas. Among the existing materials, Stellite

6K(30Cr-3Ni-4W-Co) exhibited highest corrosion resistance and IN 657(50Cr-50ni) followed. Among developed alloys, 18Cr-8Ni-Al exhibited best resistance, which was superior to Stellite 6K. For the powder erosion test executed using Al_2O_3 having 0.1-0.2 mm particle size at 20°C and 30 m/s power velocity, IN 600(15Cr-Ni) showed best result, and IN 600 followed among existing materials. Developed alloy(30Cr-40Ni-10 Al) showed best result among others which was superior to IN 600. For the tests in a gasifier and in a circulating water tank in the purification line of a 7000 Nm^3 Iwaki gasification plant, Stellite 6K was best in the gasifier and austenitic stainless steel such as SUS 304 was inferior. But, austenitic stainless steel showed good resistance in the circulating water tank of the purification line and was recognized as suitable for the material of the circulating water tank. For the developed alloy the content of Al was found appropriate to be regulated to below 3 wt.% from the viewpoint of its workability. (4 figs, 1 tab)

10708 (NEDOJ—501, pp 186-190) **Development and manufacture of equipments for coal gasification plants. Development of refractory material and ceramics.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

A testing device for corrosion resistance and slag resistance were developed in order to evaluate, select, and develop refractory materials and ceramic materials to be used for the 50 ton/d multipurpose high temperature gasifier which is intended to be constructed in recent year. Screening of the materials was also performed by investigating the behavior of each material against the effect of coal slag. Detailed investigation was done concerning chromia-contg. refractory which had been found to be effective for the improvement of slag resistance. By the investigation on the composition, kind of raw material, calcination condition, etc. it has been found that Al_2O_3-Cr_2O_3 refractory contg. 60% Cr_2O_3 had ca.4 times rate of improvement in the slag resistance as compared to conventional refractory. Further, an improved product having better-balanced characteristics such as porosity, bending strength, etc. was obtained. By the investigation on ceramic materials, a product with improved slag resistance at 1500°C was obtained by the addition of below 20 wt.% Cr_2O_3 to Al_2O_3. A testing device for slag resistance capable of performing continuous test for over 30 hr was developed, and slag resistance of several refractory were evaluated with the device. Fundamental data such as expansioncontraction characteristics, porosity, compressive strength, heat conductivity, etc. of several refractories were investigated and accumulated. For the design of a furnace having a cooling refractory wall, the relation between the wall thickness and temperature distribution at the section of the refractory wall, and the relation between the thermal stress to be generated in the refractory wall and the reliability on the crack of the refractory, etc. were investigated by the results of calculation of heat transmission, and thermal stress analysis.

10709 (NEDOJ—501) **FY 1984 NEDO Annual Report.** (New Energy Development Organization, Tokyo (Japan)). Aug 1985. 881p. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

The individual papers in this report have been entered individually into EDB and ERA.

10710 (OCCI—85) **Studies of the characteristics of carbon formed on iron and on nickel surfaces during hydrocarbon synthesis.** Khulbe, K.C.; Back, M.H. (Ottawa-Carleton Chemistry Inst., Ontario (Canada)). 1985. 71p. (MICROLOG—85-5950). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The kinetics of the hydrogenation of carbon monoxide have been studied using thin films of iron and of nickel on quartz plates. The reactivity of the films was tested for various treatments of reduction and oxidation followed by reduction. The latter treatment reduced the reactivity of both iron and nickel films. The carbon deposited as an intermediate in the reaction was analyzed by scanning electron microscopy (SEM) and its reactivity towards hydrogen was determined. These characteristics were compared with those of carbon formed by decomposition of carbon monoxide in the absence of hydrogen. Examination by SEM showed no structure or other characteristics of deposited carbon on the films of either iron or nickel. The carbon formed during the reaction was somewhat more reactive towards hydrogen than the carbon formed by decomposition of carbon monoxide. The reaction of H/sub 2/ + CO gave minor amounts of unsaturated hydrocarbons, but hydrogenation of the deposited carbon gave only saturated hydrocarbons.

10711 (PB—88-112222/XAB) **Chemically Active Fluid-Bed process for sulfur removal during gasification of carbonaceous fuels. Final report, May 1976-May 1979.** Kowazun, Z. (Esso Research Centre, Abingdon (UK)). Sep 1987. 769p. NTIS, PC A99/MF E04.

This report covers the final 3 years of a 9-year program to evaluate the Chemically Active Fluid Bed (CAFB) process for gasification and desulfurization of liquid and solid fuels in a fluidized bed of hot lime. A range of alternative fuels, including three coals and a lignite, were gasified in a 3-MWt pilot-scale gasifier, and small-scale batch tests were conducted, all in support of the design of a demonstration plant to be retrofitted to a 20-MWe natural-gas-fired power generation plant. Direct assistance was given to the start-up and troubleshooting of the 20-MWe unit, and a design study was completed on the potential use of a pressurized CAFB process to fire a high-efficiency gas turbine. The pilot plant studies demonstrated the feasibility of simultaneous gasification and desulfurization of a range of coals and a low-grade lignite. Best results were obtained using a cannel coal from New Mexico. Batch and continuous gasification tests gave much useful process and equipment information for the 20-MWe design, and the pressurized CAFB studies indicated potential for commercial viability once gas turbine inlet temperature can be raised to 1427 C.

10712 (PB—88-118658/XAB) **Reports of the Government Industrial Research Institute, Kyushu, No. 38, March 1987.** (Government Industrial Research Inst., Kyushu, Tosu, Saga (Japan)). 1987. 75p. (In Japanese). NTIS, PC E04/MF A01.

See also PB—87-217501.

Contents: chemical effects in the x-ray k emission spectra of chlorine in inorganic compounds; hydroliquefaction of coal with various iron sulfides using high-pressure dta apparatus; char gasification in h_2o/h_2 - catalysis by potassium and inhibition by h_2s (in english); extruding characteristics of cement mortar prepared from variously sized silicas and aggregates; prevention of bulking on activated sludge treatment of waste water from the food industry; analysis of metal forming by the rigid-plastic finite element method; on the automatic control of the high gradient magnetic separator system; extrusion moulding properties of cement mortar; ion-exchange characteristics of heavy metal ions on synthetic zeolite.

10713 (PB—88-119243/XAB) **Techno-economic assessment of high-pressure peat liquefaction. Research report.** McKeough, P.; Tulenheimo, V. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1987. 63p. (VTT/RR—492). NTIS, PC E04/MF A01.

This study aims to identify the most-promising process concept for conversion of peat into transport fuels by high-pressure liquefaction. The study consists of techno-economic assessments of a base-case concept and of four sensitivity-case concepts. The products are heavy primary oils, which require further upgrading into transport fuels. The designs of the processes were based on data generated in bench-scale experiments. On the basis of the results of the sensitivity studies it was concluded that thermal drying of milled peat, prior to liquefaction, is advantageous; that the concentration of peat in the feed slurry should be limited to about 30 wt% solids; that operating pressures lower than 20 MPa should be sought; and that the economics of the process are not sensitive to the chosen method separating solids from the product stream. A preliminary estimate of the costs of upgrading the primary product into gasoline was also made. Gasoline production costs in the range 10-12 USD/GJ were obtained for the base case. This is a promising result, particularly when the Finnish refinery price (exclusive of taxes) is used as a reference.

10714 **(PB—88-131297/XAB) Performance and modeling of a hot potassium carbonate acid-gas-removal system in treating coal gas.** Ferrell, J.K.; Staton, J.S.; Rousseau, R.W. (North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering). Nov 1987. 164p. NTIS, PC A08/MF A01.

The report discusses the performance and modeling of a hot potassium carbonate (K_2CO_3) acid gas removal system (AGRS) in treating coal gas. Aqueous solutions of K_2CO_3, with and without amine additive, were used as the acid gas removal solvent in the Coal Gasification/Gas Cleaning Test Facility at North Carolina State University. The AGRS consisted of a packed absorption column, one or more flash tanks for intermediate pressure reduction, and a packed stripping column operated with a reboiler. The removal of CO_2, H_2S, COS, and other species from the crude coal gas was studied, and data on the distribution of these gases in regeneration exit streams were obtained. Operating conditions for the selective removal of sulfur species were also examined. A system model for chemical solvents was developed and incorporated in a simulation program. The model was based on mass transfer rate of a key component, CO_2, with the assumption that non-key reactive components affect the equilibrium of the key component, but not its mass transfer rate. The absorption and stripping of non-key components were assumed to be controlled by equilibrium between the gas and liquid phases in these columns. An isothermal flash model for chemical solvents was also developed and included in the program. Agreement between program predictions and pilot plant data was good.

10715 **(PB—88-131305/XAB) Pollution-control considerations for low- and medium-Btu coal-gasification processes. Final report, June 1986-February 1987.** Corbett, W.E.; Erickson, L.M.; Meserole, N.P. (Radian Corp., Austin, TX (USA)). Nov 1987. 133p. NTIS, PC A07/MF A01.

The report contains a summary and an analysis of data collected by the U.S. EPA from 1977 to 1981, which relate to the characteristics of controlled and uncontrolled waste streams from low- and medium-Btu coal-gasification processes. The analysis focuses on the key waste streams that are likely to require control in a commercial coal gasification facility and identifies the pollutants which will have the greatest impacts on pollution control process selection, design, and/or performance. It indicates key data gaps and areas of process/performance uncertainty which should be considered by permit writers and reviewers of proposed environmental monitoring plans.

10716 **(PB—88-132162/XAB) Comparison of coal-based systems: marketability of medium-Btu gas and SNG (substitute natural gas) for industrial applications. Final report, July 1979-March 1982.** Olsen, D.L.; Trexel, C.A.; Teater, N.R. (SRI International, Menlo Park, CA (USA)). May 1982. 131p. NTIS, PC A07/MF A01.

See also PB—82-117383.

In assessing the marketability of synthetic fuel gases from coal, this report emphasizes the determination of the relative attractiveness of substitute natural gas (SNG) and medium-Btu gas (MBG) for serving market needs in eight industrial market areas. The crucial issue in predicting the marketability of coal-based synthetic gas is the future price level of competing conventional alternatives, particularly oil. Under a low oil-price scenario, the market outlook for synthetic gases is not promising, but higher oil prices would encourage coal gasification.

0105 By-products

REFER ALSO TO CITATION(S) 10664, 10868, 11598

10717 **(CONF-871041—1) Methodologies for prediction of deposition/corrosion/erosion in fossil energy technologies.** Natesan, K. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002936/JAW.

From Advanced research and technology development direct utilization; Morgantown, WV, USA (13 Oct 1987).

The objectives of this program are to develop a validated analytical capability (methodology) to understand the process environmental conditions and to predict long-term corrosion/erosion behavior of structural materials in advanced fossil technologies (e.g., gasification, direct coal-fired heat engines, advanced pulverized coal-fired boilers) under development by the Department of Energy (DOE). The program would (1) develop mathematical (analytical) formalisms that predict the interaction of coal-derived gases and particle-laden flows with materials of construction; (2) experimentally verify the formalism with existing data derived from process development units (PDUs) and laboratory facilities; and (3) apply the validated methodology models in the prediction of long-term corrosion/erosion behavior of construction materials as a function of coal feedstock chemistry and system operating conditions. The outcome of this program - a validated analytical methodology for predicting material performance - would be directly applicable for resolving critical technology-specific problems, such as deposition and corrosion damage at elevated metal temperatures in p-c boilers, corrosion/erosion degradation in direct coal-fired gas turbines, severe erosion in FBC systems, and hot corrosion/erosion damage in turbines of coal gasification combined-cycle and cogeneration plants.

0106 Properties

REFER ALSO TO CITATION(S) 10660, 10663, 10697, 10698, 10717, 10749, 10763, 10765, 10770

10718 **(CONF-870410—39) Density separation of chemically modified coal macerals: A two dimensional separation method for more homogeneous macerals.** Dyrkacz, G.R.; Choi, Chol-Yoo; Stock, L.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003115/JAW.

From 193. national meeting of the American Chemical Society; Denver, CO, USA (5 Apr 1987).

Density gradient centrifugation (DGC) appears to be one of the most effective separation methods for reducing the heterogeneity of coal by separating the three maceral groups, and concomitantly provides some idea of the range of physical and chemical variation that exist within a coal sample. However, this still represents only a first order separation. We rarely can resolve the individual macerals that make up the maceral groups because their density distributions overlap. Chemical modification of the coal maceral particles coupled with density gradient centrifugation was used as an approach to higher maceral resolution. 8 refs., 5 figs., 1 tab.

10719 **(CONF-870802—28) Small angle neutron scattering studies of swelled coal.** Winans, R.E.; Thiyagarajan, P. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003010/JAW.

From 194. American Chemical Society national meeting; New Orleans, LA, USA (30 Aug 1987).

The objective of this study is to determine changes that occur in the physical structure of coals upon swelling in an organic solvent. The phenomenon of coal solvent swelling is being used to characterize coal structure especially in the determination of molecular sizes between crosslinks. Small angle neutron scattering (SANS) is the approach used in this study to examine the changes in pore structure in a Pittsburgh No. 8 seam hvA bituminous coal, Argonne Premium Coal Sample No. 4. Two perdeuterated solvents are used, benzene for non-swollen and pyridine for swelling conditions. The deuterated solvent provides a large contrast between the solvent and the solid coal for neutron scattering. Our current results show that the pore structure of a coal swollen in pyridine is dramatically altered from its original state. 8 refs., 4 figs., 1 tab.

10720 **(CONF-870999—1) Organic sulfur species in Argonne premium coal Sample No. 3 Illinois No. 6.** Winans, R.E.; Scott, R.G.; McBeth, R.L.; Neill, P.H. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002862/JAW.

From 2. international processing and utilization of high-sulfur coal conference; Carbondale, IL, USA (28 Sep 1987).

Objectives of this study were to identify and quantify the organic sulfur compounds present in a high-sulfur Illinois bituminous coal. In order to devise efficient methods for removing organic sulfur, it is important to know what types of molecules contain sulfur. However, these molecules are typically bonded into an insoluble macromolecular network. Vacuum pyrolysis was used to break down this network into smaller molecules. The coal was pyrolysed, either directly into a mass spectrometer (PyMS) or in a batch mode where the tars were collected and analyzed by low eV ultra high resolution MS. In the PyMS experiment, the aliphatic sulfur compounds evolved at 250 to 350°C while aromatics volatilized at a much higher temperature, 425 to 525°C. Aromatic species dominate and include thiophenes, benzothiophenes and dibenzothiophenes. It is interesting to note that a significant amount of thiophenol species are seen. In a low voltage HRMS study, larger molecules were found with molecular ions ranging from m/z 200 to 600. They appear to be highly alkylated, annellated thiophenes, but the PyMS results indicate the majority are probably less than four rings in size. A large number of aromatics containing an additional heteroatom have been found. 12 refs., 5 figs.

10721 **(CONF-871041—5) The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MIIR) and supercritical fluid chromatography (SFC) for waste characterization.** Raphaelian, L.A.; Green, D.W. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003088/JAW.

From Advanced research and technology development direct utilization; Morgantown, WV, USA (13 Oct 1987).

In processes involving coal and other fossil fuels, wastes are generated that are normally biologically or chemically treated before disposal. To assist in determining the best treatment for obtaining material suitable for disposal, a knowledge of the chemical composition of the wastes is required. Typically, these wastes contain a complex mixture of organic compounds. One objective of this project is to enhance the capabilities of analyzing complex mixtures by using gas chromatography/matrix isolation infrared spectroscopy. The second objective is to simplify the mixtures found in solid wastes into less complex mixtures so that a better separation can be made by the gas chromatograph portion of GC/MS and GC/MIIR. The technique used for this is supercritical fluid chromatography.

10722 **(CONF-871193—1) Application of inverse gas chromatography to fluidity studies.** Winans, R.E.; Neill, P.H. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002896/JAW.

From 2. coal research conference; Wellington, New Zealand (2 Nov 1987).

We have developed a new method, Inverse Gas Chromatography (IGC), for evaluating coal fluidity at elevated temperatures. This technique is being used to follow changes in coal structure which affect the coal's fluidity. In IGC, which is used to study polymers, the retention of a probe molecule on the coal surface in a flowing gas system is followed as a function of temperature. The relative size of changes in the structure and the temperatures at which these changes occur can be measured very accurately and reproducibility with this technique. The results compare favorably with more traditional methods of measuring coal fluidity while, in addition, providing data which can be used to understand the underlying chemical and physical changes in structure with weathering.

10723 **(CONF-871193—2) Chemical and physical structure of coals.** Winans, R.E.; McBeth, R.L.; Scott, R.G.; Thiyagarajan, P.; Botto, R.E.; Hayatsu, R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002874/JAW.

From 2. coal research conference; Wellington, New Zealand (2 Nov 1987).

New information on the chemical and physical structure of coals and separated coal macerals strongly suggests that polycyclic aromatics do not dominate the aromatic structure except in the very high rank coals and in inertinites. Two very different approaches have led to these conclusions. First, a very mild, selective oxidation method has been used to break down the coal macromolecular structure into molecules which can be readily characterized. The products are dominated by single ring aromatics. Second, small-angle neutron scattering has been used to study solvent swollen coals. There is no evidence from the data for a layered structure, instead long tubular pores are being formed as an apparent result of changes in the hydrogen-bonding in the matrix. These results have important implications in better understanding coal reactivity, especially in milder processes. 20 refs., 8 figs., 1 tab.

10724 (CONF-8703215—, pp 60-63) **Requirements for metallurgical coke in present day blast furnace operation.** Velikonja, L.; Kim, S.M. 1987. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751240/JAW.

From 3. Aachen steel colloquium (ASC-3): manufacture of iron and steel and exhibition; Aachen, F.R. Germany (19 Mar 1987).

Modern blast furnace operation (large blast furnaces with auxiliary fuels blown in) requires coke with special physical and chemical properties. The strength of the coke can be increased and its reactivity can be reduced by influencing the processes during the coking stage, particularly in the plastic zone (mesophase).

10725 **(CONF-8708183—1) The nature and origins of coal macerals.** Given, P.H.; Dyrkacz, G.R. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002989/JAW.

From NATO advanced study institute conference on new trends in coal science; Datca, Turkey (24 Aug 1987).

The definition and nature of coal macerals is presented in terms of some current research. Recent work on the nature of several precursors of the liptinite maceral groups are discussed and compared to the corresponding liptinite macerals. The importance of separating macerals is discussed, and the results from the density gradient centrifugation method of maceral separation is briefly reviewed. 51 refs.

10726 **(DOE/FC/10621—2500) Low-rank coal thermal properties and diffusivity: Final report.** Ramirez, W.F. (Colorado Univ., Boulder (USA). Dept. of Chemical Engineering). Jun 1987. Contract AC21-84FC10621. 134p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88001009/JAW.

This project developed techniques for measuring thermal properties and mass diffusivities of low-rank coals and coal powders. Using the concept of volume averaging, predictive models have been developed for these porous media properties. The Hot Wire Method was used for simultaneously measuring the thermal conductivity and thermal diffusivity of both consolidated and unconsolidated low-rank coals. A new computer-interfaced experiment is presented and sample container designs developed for both coal powders and consolidated coals. A new mathematical model, based upon volume averaging, is presented for the prediction of these porous media properties. Velocity and temperature effects on liquid-phase dispersion through unconsolidated coal were determined. Radioactive tracer data were used to determine mass diffusivities. A new predictive mathematical model is presented based upon volume averaging. Vapor-phase diffusivity measurements of organic solvents in consolidated lignite coal are reported. An unsteady-state pressure response experiment with microcomputed-based data acquisition was developed to estimate dispersion coefficients through consolidated lignite coals. The mathematical analysis of the pressure response data provides the dispersion coefficient and the adsorption coefficient. 48 refs., 59 figs., 17 tabs.

10727 (DOE/PC/50813—T1) **Effects of stresses on optical and chemical properties of coal: Final report.** Ting, F.T.C. (West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography). 1987. Contract FG22-82PC50813. 186p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE87008600/JAW.

This report deals with measurements of the orientation of the official properties of coal samples with respect to the bedding plane, chiefly the reflectivity of vitrinites. Methods of measurement are discussed. The official measurements are then related to the stresses and the amount of methane desorbed from the coal. Two sections have been entered individually into EDB and ERA. (LTN)

10728 (DOE/PC/50813—T1, pp 1-79) **[Effect of stress on coal].** 1987. NTIS, PC A09/MF A01. Order Number DE87008600/JAW.

In Effects of stresses on coal on optical and chemical of coal: Final report.

The orientation of the optical axis, or the minimum reflectance of the reflectance indicatrix of vitrinite, can be used to indicate the direction of maximum stress, i.e., the resultant stress of vertical compaction and lateral stress, during coalification. Furthermore, the attitude of the minimum reflectance with reference to bedding plane is a good parameter for evaluating whether maximum thermal maturation is achieved prior to or after folding or other structural changes, and thus reflects the tectonic and coalification history of coal. The purpose of this study was to investigate the orientation of the reflectance indicatrix of vitrinite and relate it to the coalification history of coal seams. A technique was developed to measure and calculate the direction of the optical axis of vitrinite, and because of the bioaxiality of anthracite, both uniaxial and biaxial indicatrix models were taken into consideration. A series of coal samples of different rank and from different geographic locations (anthracite from Pennsylvania, and bituminous coal from highly tectonically disturbed regions in the Canadian Rockies and from the Appalachian coal region) were collected and examined. The analysis results illustrate that in both the Canadian Rockies and Appalachian coal region, at least in the sampled areas, the optical axes exhibit a "fixed" angular relationship with stratification. These suggest that coalification was achieved prior to folding in those two studied areas.

10729 (DOE/PC/50813—T1, pp 80-126) **Relationship between bireflectance ratio of vitrinite and methane concentration in coals.** Ting, F.T.C.; Wang, P.B. 1987. NTIS, PC A09/MF A01. Order Number DE87008600/JAW.

In Effects of stresses on optical and chemical of coal: Final report.

This study was to investigate the relationship between bireflectance ratio of vitrinite and methane concentration in coals. The precise relationship between them is difficult to find because of the escaping of methane. Microporosity was used because microporosity influences methane concentration. The measurements of bireflectance ratio of vitrinite were made on a Leitz Orthoplan reflected light microscope and measurements of microporosity were made on a desorption apparatus. The results of this study show that a relationship between optical anisotropy and methane concentration in coal does exist. Coals of higher bireflectance ratio of vitrinite have lower desorption values (lower microporosity). When ranks are the same, coals of bireflectance ratio greater than 0.17 tend to have lower desorption values than that of coals of bireflectance ratio lower than 0.14. Therefore high optical anisotropy suggests that methane produced during coalification due to breaking off of cross-like under extensive pressures occur as "free methane" without being trapped inside micropores. This study can be utilized to predict methane concentration during mining operations or mining planning. It also has a potential application to exploration of coal gas as natural gas.

10730 (DOE/PC/79863—T5) **High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.** (Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center). 1987. Contract FC22-87PC79863. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88001332/JAW.

Individual projects are processed separately for the data base. (CBS)

10731 (DOE/PC/79863—T5, pp 1-14) **Interactions of sulfur-containing compounds with transition metal clusters and metal surfaces II.** Dunkerton, L.V.; Tyrrell, J. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

Reactions of sulfur-containing substituted dibenzothiophenes with the transition metals have been continued. Several substituted dibenzothiophene complexes have been prepared with Fe(II), Mo(II), and Ru(III). Work focused mainly on the use of ^{31}P-NMR studies to identify phosphine ligands of these complexes. This ongoing task is directed towards obtaining a better understanding of the role in-situ metal sulfides play in the coal desulfurization process. The theoretical study of the interaction of sulfur-containing species with small metal clusters is presently focused on the nickel dimer and its interaction with heteroatom ligands which can complex to metal atom d-orbitals, of which nitric oxide has been used as a prototype ligand for preliminary calculations. For the nickel dimer fragment, the optimized structure has the bond between the nickel atoms formed by the interaction between the singly occupied 4s orbitals, and there is a singly occupied d-orbital on each nickel atom. In the first system studied, the NO molecule was located along the internuclear axis connecting the two nickel atoms. The second system being studied has the NO fragment at an "on top" position in such a way that the nitrogen atom can interact with both nickel atoms at the same time. Results indicate the energetic preference for the bridged approach of the nitric oxide molecule towards a metal surface represented by the two nickel atoms. 8 refs., 2 figs.

10732 (DOE/PC/79863—T5, pp 15-22) **Vanadium speciation in Illinois coal.** Koropchak, J.A. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The focus of this program is the study of trace element speciation in coal by DMSO extraction and chromatographic separation with element-selective detection by ICP-AES. The study of titanium-containing components is described. Further, detailed characterization of chromatographic procedures is described. Potential interferences to size-exclusion chromatography and means for their alleviation are discussed. Included is the use of ion-pairing reagents in non-aqueous solvents. Preliminary evaluation of the application of thermospray as an interface to HPLC-ICP-AES is described. 4 refs., 1 fig., 2 tabs.

10733 (DOE/PC/79863—T5, pp 69-78) **Microcrystalline iron sulfide particles in coal: A Moessbauer study.** Smith, G.V.; Hinckley, C.C.; Saporoschenko, M. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

In this reporting period, a new cobalt-57 source was installed. Low-temperature Moessbauer spectra of several acid-washed chars were obtained. Estimates of particle size distribution were developed for a standard iron oxide sample. Preliminary results show a distribution of particle size centered at 80 A. 1 ref., 5 figs., 1 tab.

10734 (DOE/PC/79863—T5, pp 79-84) **Mixing of sulfur during coal conversion processes and characterization of organic sulfur types in coal.** Smith, G.V.; Dunkerton, L.V.; Phillips, J.B.; Hinckley, C.C. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The mixing of sulfur between the inorganic (pyritic) phase and organic phase of coal may influence the extent of total sulfur removal during coal conversion processes. This project is designed

to determine the extent of such mixing. The synthesis of ^{34}S-labelled dibenzothiophene is underway in which ^{34}S will be tracked between the H_2S evolved and the inorganic sulfur. To date two converging synthetic schemes for the preparation of ^{34}S-labelled dibenzothiophene have been initiated, and progress has been achieved in both towards the introduction of the sulfur from thiourea, on 2,2'-disubstituted biphenyls. Thus, in the scheme from diphenic acid, the preparation 2'-acetamidobiphenyl-2-thiol has been achieved to date. In the scheme from dinitrobiphenyl, the preparation of 2'-nitrobiphenyl-2-thiol has also been achieved. The migration of sulfur from inorganic to the organic phase has also been carried out with 2-hydroxybiphenyl. These studies have been carried out using a microreactor/multiplex gas chromatography/Moessbauer system. It was found that sulfur was incorporated into 2-hydroxybiphenyl to form dibenzothiophene, thus proving migration of sulfur from the inorganic to the organic. 2 refs.

10735 (DOE/PC/79863—T5, pp 91-94) **Coal-ash agglomeration during combustion and/or gasification.** O'Brien, W.S. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

This project seeks to develop a procedure to identify the lowest temperature at which particles of coal ash begin to stick together. This test will consist of oxidizing the coal under precisely controlled conditions, then heating the sized coal-ash particles to progressively higher temperatures until the particle size distribution significantly increases, indicating the onset of agglomeration. The agglomeration temperatures of a series of different coals will then be compared with their respective chemical and physical characteristics, including their ASTM-measured ash-fusibility properties.

10736 (DOE/PC/79863—T5, pp 111-125) **Spontaneous combustion of coal and maceral-enriched fractions under storage and pneumatic transport conditions.** Malhotra, V.M.; Crelling, J.C. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The objective is to understand the mechanisms responsible for spontaneous combustion of ultrafine bituminous coal and maceral-enriched fractions under storage and pneumatic transport conditions and also to develop a retardation treatment for spontaneous combustion. Water-wetted and dry coals were subjected to identical air flow experiments at $290°K < T < 500°K$. The detailed FTIR analysis suggests that water-wetted coals show a different oxidation pathway from dry coals. In addition, these results suggest that water-wetted coals are less extensively oxidized than dry coals. The pyrolytic measurements under nitrogen flow conditions suggest that thermal reaction pathways are different under nitrogen and air flow conditions for Elkhorn bituminous coal at $290°K < T < 700°K$. 7 refs., 8 figs.

10737 (DOE/PC/80522—T5) **Metal arene complexes in coal structure determination: Quarterly report for the period June 1987-August 1987.** Woolsey, N.F. (North Dakota Univ., Grand Forks (USA). Dept. of Chemistry). Nov 1987. Contract FG22-85PC80522. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003202/JAW.

The formation of benzylic hydroperoxides was shown to be a viable synthetic objective by their cleavage to oxygenated species in moderate, unoptimized yields. Oxidation of benzylic anions of metal arene complexes to oxygenated derivatives such as an alcohol, ketone or hydroperoxide are satisfactory target derivatives for this study. Oxidation of the benzylic anion of hexamethylbenzenechromiumtricarbonyl using a phenyl tosyloxaziridine and with chromium pentoxide gave low yields of the desired products. Electrochemical oxidation of a related iron complex anion in the presence of oxygen resulted in metal rather than anion oxidation. The cycloaddition reactions previously reported were extended but a reaction with an isocyanate gave several unidentified products. Attempted rhodium insertion in a phenyl-benzylic carbon-carbon bond resulted in aryl carbon-hydrogen insertion and ultimately formation of a Rh_2^{+4} dimeric complex.

10738 (HEPC—201) **Application of coal ash to civil engineering material. Interim report(1) Physical and chemical properties of coal ash (Part 1).** Igarashi, Kazuhiko; Tobana, Kosaku. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Apr 1982. 37p. (In Japanese). The Hokkaido Electric Power Co., Inc., 1-2, Odori-Higashi, Chuo-ku, Sapporo, Japan.

This paper summarizes the test results of physical and chemical properties (composition, trace element and eluted matter) on fly ash and clinker. The test was made from June, 1980 to January, 1982 to study the application of coal ash produced at a thermal power plant of Hokkaido Electric Power Co. to civil engineering material. Since the test of trace elements was made only once for one sample of Tomato ash arbitrarily taken for reference, the test result does not represent the whole ash. The test result indicates that the data of physical properties and main chemical compounds represent Japanese coal ash and the elution of heavy metals does not confront any problems. (1 ref, 3 figs, 25 tabs, 4 photos)

10739 (HEPC—202) **Application of coal ash to civil engineering material. Interim report(2) Engineering characteristics test of coal ash (Part 1).** Igarashi, Kazuhiko; Tobana, Kosaku; Fujita, Keiichi. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Jun 1982. 88p. (In Japanese). The Hokkaido Electric Power Co., Inc., 1-2, Odori-Higashi, Chuo-ku, Sapporo, Japan.

This paper summarizes the test results of engineering characteristics of coal ash by the test and research focusing upon the study on application of coal ash to the road constructing material. The study has been made since 1980 as a part of the research of application of coal ash produced at a thermal power plant of Hokkaido Electric Co. to the civil engineering material. The report is characterized by the presentation of the special features of coal ash as not only the soil material but as pozzolanic material and the demonstration of advantages as the material obtained by the investigation of the variation with time. (2 refs, 46 figs, 23 tabs, 22 photos)

10740 (HEPC—203) **Application of coal ash to civil engineering material. Interim report(3) Test road using coal ash (coarse particle ash available), (Construction report, 1).** Igarashi, Kazuhiko; Tobana, Kosaku; Fujita, Keiichi. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Jun 1982. 96p. (In Japanese). The Hokkaido Electric Power Co., Inc., 1-2, Odori-Higashi, Chuo-ku, Sapporo, Japan.

This paper summarizes the test result of physical properties of coal ash, the construction work of test road applying coal ash (coarse particle ash available) as the pavement flux, roadbed material and frost heaving inhibitor material to the ash landfill road in the site of Takikawa Power Plant, the result of field test carried out or the same time of the construction of the test road and the measurements by the buried instruments. No crack on the surface of the road has been observed so far and no effects frost heaving or subsidence have been found. (6 refs, 43 figs, 44 tabs, 29 photos)

10741 (HEPC—301) **Application of coal ash to civil engineering material. Interim report(4) Reclamation of grassland and farmland using coal ash (Part 1).** Igarashi, Kazuhiko; Yoshida, Osamu. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Mar 1983. 37p. (In Japanese). The Hokkaido Electric Power Co., Inc. 1-2, Odori-Higashi, Chuo-ku, Sapporo, Japan.

This paper presents the agricultural characteristics of and plant growing situation at the grassland reclaimed from the landfill or fill-up ground of coal ash. Since the crops roots deep just to the layer of coal ash at the initial step of growing at the land reclaimed using coal ash as the bed in most cases, the land is desirable to be covered with a significantly large amount of earth. The periodical measurement of pH and EC of the pasture using coal ash as the bed had been made since seeding. The value of pH was lowered in either case of coal ash or clinker. Since molybdenum is closely related to lime and copper, the soil condition concerning pH, EC and humus must be understood for applying coal ash. Any special rolling compaction is unnecessary. Amount of coal ash of 130% of planned value is required for the reclamation considering the natural compaction. (9 refs, 14 figs, 19 tabs, 10 photos)

10742 **(HEPC—302) Study on practical application of hardened material of coal ash. Interim report(3) Manufacturing process and physical properties of hardened material.** Ueno, Tsutomu; Tanaka, Shigeo; Kishimoto, Hiroshi; Takarazaki, Yoshio. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Feb 1983. 51p. (In Japanese). The Hokkaido Electric Power Co., Inc. 1-2, Odori-Higashi, Chuo-ku, Sapporo, Japan.

The manufacturing process, physical properties and viability of CAS lightweight concrete, CAS lightweight cellular concrete and CAS aggregate produced mainly from coarse particle coal ash were experimentally investigated. Although the ratio of strength to specific gravity of CAS lightweight concrete cured under normal pressure is large, the drying shrinkage must be lowered. Although the ratio of strength to specific gravity of CAS lightweight cellular concrete cured under high pressure is large, the freeze resistance is low. The performance of CAS lightweight cellular concrete cured under normal pressure is akin to that of commercially available product cured at 100°C or less under normal pressure, but the drying shrinkage must be lowered. The quality of CAS lightweight cellular concrete cured under high pressure is almost the same as that of commercially available ALC, but the weight is lighter and the heat resistance is higher. Since the water absorption ratio of CAS aggregate is high, there is a problem that the freeze resistance of concrete is lowered. (9 refs, 23 figs, 23 tabs)

10743 **(PB—88-116264/XAB) Trace-element distributions in some New Mexico coals. Technical report (Final), 20 January 1986-28 February 1987.** Kuellmer, F.J.; Kendrick, D.T.; Baker, L. (New Mexico Inst. of Mining and Technology, Socorro (USA)). Apr 1987. 279p. NTIS, PC A13/MF A01.

Coal seams and adjacent rock samples were collected from two drill-core sites in the Lee Ranch Mine of the San Juan Basin and from a channel sampling of a recent mine-working face in the York Canyon Mine of the Raton Basin, both in New Mexico. Minor and trace elements occur principally in a U-shaped pattern with the maxima or tails of the U just inside the upper and lower seam boundaries. Any parting within the seam may also act as a seam boundary with a higher element content just above or below. Because the highest trace-element content is related to seam boundaries, it is concluded a diagenetic or hydrologic redistribution of trace or minor elements has occurred after deposition in the peat swamp. The U-shaped heterogeneous distribution of the trace elements suggests physical removal of the top or the bottom of the seam where the trace elements are high may be an economic way to concentrate valuable or troublesome ingredients without having to treat the entire seam.

10744 **Preliminary study of the reflectance of huminitic macerals in recent surface peats.** Cohen, A.D.; Raymond, R. Jr.; Archuleta, L.M.; Mann, D.A. (Los Alamos National Laboratory, NM (USA). Earth and Space Sciences Division). *Organic Geochemistry;* **11**: No. 5, 429-430(1987). (CONF-8511319—).

From 2. annual meeting of the Society for Organic Petrology; Houston, TX, USA (7 Nov 1985).

Mean random reflectances of huminitic macerals were measured from 12 polished microtome sections of surface peats collected from a wide variety of depositional and ecological settings. At least two distinct subtypes of huminitic macerals were evident in each peat sample. The average reflectance of all huminitic macerals was 0.16, ranging 0.02 to 0.50. Differences in plant source ingredients and depositional settings appeared to have a greater effect upon reflectances of huminites than differences in climate. Reflectance did not correlate with either fixed carbon or Btu. 3 tabs.

0108 Waste Management

REFER ALSO TO CITATION(S) 10667, 10711, 10738, 10739, 10740, 10741, 10742, 10762, 10773, 11399, 11714

10745 **(CONF-870999—5) An investigation of SO/sub x/-NO/sub x/ control in a staged cyclone coal combustor with pressure-hydrated limestone injection.** Swift, W.M.; Teats, F.G. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003031/JAW.

From 2. international processing and utilization of high-sulfur coal conference; Carbondale, IL, USA (28 Sep 1987).

The results of a series of tests to investigate the control of SO/sub x/-NO/sub x/ emissions from a staged cyclone coal combustor are presented. The tests, which involved the injection of a pressure-hydrated limestone into the first stage of a nominal 2 MW/sub t/ combustor, were performed using Illinois No. 6 medium- and high-sulfur coals (1.6% S and 2.7% S). A reduction in SO_2 emissions as high as 80% was obtained at a Ca/S molar ratio of 3.5 with fuel-rich first-stage combustion and approximately 80% excess air in the second stage. The reduction in SO_2 emissions declined with decreasing Ca/S molar ratio and was considerably less when the excess air in the second stage was reduced to 20%. The results indicate that the second-stage combustion temperature, as well as Ca/S ratio, is a major factor in the control of SO/sub x/ emissions. NO/sub x/ emissions from the combustor ranged from 0.4 to 1.0 lb $NO_2/10^6$ Btu (17 to 43 ng/J), as compared with the New Source Performance Standard of 0.6 lb $NO_2/10^6$ Btu (26 ng/J). Although the amount of data obtained with the pressure-hydrated limestone is fairly limited, the results are consistent with (1) the results obtained in similar tests at ANL with a conventional limestone, and (2) results reported in the literature for limestone injection into staged, slagging combustors.

10746 **(CONF-870999—7) NO/sub x/ and SO/sub x/ removal in a high sulfur spray dryer system.** Farber, P.S.; Huang, H.S.; Allen, J.W. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03. Order Number DE88003043/JAW.

From 2. international processing and utilization of high-sulfur coal conference; Carbondale, IL, USA (28 Sep 1987).

Potential acid-deposition legislation is likely to call for extensive reductions of sulfur dioxide (SO_2) emissions in the midwestern United States. These reductions will be aimed primarily at the older utility power plants that operate without scrubbers. A study by Argonne National Laboratory (ANL) has indicated that at least 25 plants in Illinois, Indiana, and Ohio would be affected by this legislation. If fuel switching is one of the allowable options under whatever legislation is mandated, the impact on the midwestern coal industry will be enormous, with dozens of mines being forced to close. There is also a growing realization that the role of nitrogen oxides (NO/sub x/), although not as critical as that of sulfur oxides (SO/sub x/), has to be included in any acid-deposition control scenario. The development of environmental control processes for the simultaneous control of NO/sub x/ and SO/sub x/ is one of the national priorities being pursued by the US Department of Energy. The specific effort to develop combined SO/sub x//NO/sub x/ control technology in spray dryers is centered around laboratory and field efforts at ANL. It has been found that a combination of modified process conditions and addition of caustic soda to the lime-based spray dryer system allowed for removal of some of the nitrogen oxides from the flue gases, with some increases in the sorbent ratio necessary for the system to maintain its ability to remove sulfur dioxide. The existence of a temperature "window" that is ideal for NO/sub x/ removal could not be verified during the field tests, primarily due to an upper limit of 210 to 215°F in the tests. A distinct relationship (above 190°F) between the equivalence (defined as the chemical combining capacity) ratio of the reactants and the pollutants, the thickness of the filter cake, and the ratio of sulfur oxides to nitrogen oxides at the system entrance was found for the removal of NO/sub x/ pollutants.

10747 **(DOE/PC/79796—T1) Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 1 for the period June 5, 1987-August 31, 1987.** (Energy and Environmental Research Corp., Irvine, CA (USA)). 15 Sep 1987. Contract FC22-87PC79796. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002252/JAW.

The objective of this project is to demonstrate gas reburning-sorbent injection (GR-SI) emission control technology on three pre-NSPS coal fired utility boilers in Illinois. The goals are to achieve NO/sub x/ and SO/sub x/ emission reductions of 60 and 50%, respectively. Work on Phase 1 of the program, Design and Permitting, commenced on June 5, 1987. During this quarter, work focused on project planning and organization, the National Environmental Policy Act (NEPA) review and preliminary process designs of GR-SI for the three host units and three alternate sites. Kickoff meetings and a project inauguration were held with the funding participants and host utilities. DOE comments on the Environmental Information Volume (EIV) were received and the data necessary for the revised EIV were compiled. The analysis of the three host units confirmed that the NO/sub x/ and SO/sub x/ emission goals should be achievable.

10748 **(DOE/PC/79798—T1) LIMB Demonstration Project Extension: Quarterly report No. 1 for the period May, June, July, 1987.** (Babcock and Wilcox Co., Barberton, OH (USA). Contract Research Div.). 15 Sep 1987. Contract FC22-87PC79798. 55p. (CRD—1171). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002251/JAW.

The subject of this report is progress during the quarter in Design and Permitting; Site Preparation; and Long-Lead Time Item Procurement. The project management team was committed to the project and reporting requirements were addressed. Consol Technology Transfer physical and chemical characterization of twelve commercial hydrated limes was initiated, and preliminary results are presented. The by-pass humidification duct and Coolside sorbent feed system are undergoing detailed design. Also, Consol has performed an analysis of electrostatic precipitator performance expected at Edgewater. The conclusions of the study are presented. Coolside waste is being characterized in a test program to obtain technical information in support of attaining a disposal permit for the waste. Long-lead time items such as the atomizing air compressor and flue gas reheater were ordered to allow delivery in time for installation without a schedule delay. The Retired Precipitator Demolition task has been initiated with the beginning of asbestos insulation removal. 6 figs., 5 tabs.

10749 **(HEPC—303) Study on practical application of hardened material of coal ash. (Final report). Application to unburned artificial lightweight aggregate.** Ueno, Tsutomu; Suzuki, Takeshi; Tanaka, Shigeo; Kishimoto, Hiroshi; Kawaguchi, Tadashi; Takarazaki, Yoshio. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Mar 1983. 48p. (In Japanese). The Hokkaido Electric Power Co., Inc. 1-2, Odori-Higashi, Chuo-ku, Sapporo, Japan.

Apart from the previous report, the manufacturing process and physical properties of unburned artificial lightweight aggregate (CAS aggregate) which seems to be promising in the manufacturing process and marketability were experimented again using twelve CAS aggregates. The problem of water absorption properties remains awaiting solution. Only one CAS aggregate (Aggregate No. 3-3) has the higher durability factor (DF) than those of natural fine aggregate and volcanic ash and the other one has lower DF than that of natural fine aggregate and higher DF than that of volcanic ash. The DF by the concrete mixings shows another result. Although CAS aggregate belongs to LA according to the classification of JIS, the quality is below the standard. The concrete using No. 3-3 CAS aggregate is evaluated similar to that using volcanic ash as the aggregate. (10 refs, 35 figs, 13 tabs)

10750 **(HEPC—501) Application of coal ash to civil engineering material.Interim report(5) Reclamation of grassland and farmland using coal ash (Part 2).** Igarashi, Kazuhiko; Yoshida, Osamu. (Hokkaido Electric Power Co., Inc., Sapporo (Japan)). Dec 1985. 17p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88770027/JAW.

This paper presents the progress of farmland reclamation and cultivationo of crops and the results of improving the Kuroboku-stony trass and heavy clay by coal ash. The following tests were made: reclamation of grassland in the ash landfill of a thermal power plant and in the site of laboratory; relationship between the reclamation of municipal farmland of Ebetsu by coal ash and pH of soil; cultivation of crops at coarse particle-ash blended earth and cultivation of pasture at mixed soil of heavy clay and clinker. When the soil is covered with a thickness of 25 cm or more of ash, less damage caused by drying, normal growth of crops and low pH are expected. It is necessary for applying coal ash to the agricultural ground improvement to lay covered conduit at the bottom of ground in order to prevent the foundation of agricultural land from breaking and to drain off the water derived from a big rainfall. The goal was almost attained in the cultivation of pasture by using the mixed soil of Kuroboku-stony trass and coarse particle ash. The synergistic effect of the effect by exchanging the sandy soil with clinker for improving the heavy clay and the adjustment of pH of soil was observed. The experimental study on the relationship between the chemical substances contained in coal ash and the animals including the human and plants will be needed. (7 figs, 5 tabs, 2 photos)

10751 **Determination of the sodium carbonate-sulfur-dioxide reaction rate coefficient at 450°F.** Stelson, A.W. (Atlanta Univ. Center, Inc., GA). *Journal of the Air Pollution Control Association;* 37: No. 7, 830-832(Jul 1987). Contract FG22-85PC80539.

Various solid sorbents have been identified as potential candidates for flue gas desulfurization schemes. This research will demonstrate a theoretical and graphical technique which yields the particle size independent reaction rate coefficient from thin bed sorbent studies.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 10701, 10702, 10715, 10745, 12448, 12451

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 10725, 10727, 10728, 10729

10752 **(BMFT-FB-T—86-201) Exploration of the coal deposits in the Ruhr district by seismic measurements and exploratory drilling. Final report.** Ameely, L.; Klease, M.; Palm, H.; Bieg, G.; Fiebig, H.; Gangel, L.; Heil, H.W.; Jonas, H.; Klesse, E.; Kunz, E. (Bundeaministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Ruhrkohle A.G., Essen (Germany, F.R.); Geologisches Landesamt Nordrhein-Westfalen, Krefeld (Germany, F.R.)). Dec 1986. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751706/JAW.

As an integral part of the long-term exploration program of Ruhrkohle AG to survey the reserve concessions in the North-Rhine Westphalian hard coal district, 68 exploratory holes were drilled and profile as well as area seismic measurements covering 37,4 km and 13,7 km/sup 2/, respectively, were carried out. The results of these efforts were evaluated including the far more extensive general exploration work conducted by Ruhrkohle in order to find large-scale regional and, if possible, over-regional correlations of stratigraphy and tectonics in overlying rock and seam-bearing carboniferous strata. Over-regional evidence is limited at the present state of the exploration program due to the premature termination of exploration work by breaking off the project. A conclusive statement on the whole reserve deposit will only be feasible in 5 to 10 years, provided the intensive exploration work will be resumed. Basically, the conditions of the deposits in the reserve concessions are as follows: Stratigraphy and tectonics of the overlying strata are generally in agreement with previous expectations. Stratigraphy and tectonics of the seam-bearing carboniferous strata in the partial areas so far explored are, apart from the generally greater geosynclinal depth, identical with those parts of the deposit which are opened up and being worked. In general, better conditions had been expected. The deposit tends to deplete from the

south to the north by seam pinching or impurities. Tectonic stresses acting on the areas explored so far are in principle higher than originally assumed. This applies in particular to the structure of the anticlines marked by associated longitudinal tectonics that are essentially stronger than expected. The expectation of a diapiric petering-out of the anticlines in the carboniferous strata towards the north remains unconfirmed. With 30 figs..

10753 (NEDOJ—501, pp 193-207) **Basic survey of coal reserves in Japan.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Prospecting of coal source in the unsurveyed area of Japan has been undertaken since 1982 mainly by drilling. And offshore geophysical prospecting and offshore drilling were also done in 1984. Distribution of coal measure of good quality with mild dip in the minable depth was estimated in West Sonogi-oki area. In opposition to the conventional estimation, wide distribution of continuous coal seam group was confirmed in Ariake-kai area, which preserves the same coal quality and the same seam thickness as the working Miike coal mine. In North Ashibesu area, distribution of Bibai coal measure (which is the main working mine of Ishikari coal mine) was confirmed in the relatively shallow depth with mild dip. Sufficient quantity of two coal seams of good coal quality was also confirmed in the whole area. In Hokuyo area, stable distribution of Shakubetsu and Yubetsu coal measures (which are the main working mines of Kushiro coal field) were found at shallow depth. Two coal seams of the Shakubetsu seam were found in relatively wide area in the central area of the coal field, and one more coal seam was found in the east area. In Ruship area, stable, shallow and wide distribution of the third seam of Yubetsu coal measure was confirmed. (7 figs)

0120 Mining

REFER ALSO TO CITATION(S) 12420

10754 (EC—8602) **Geochemistry of metal-organic complexes in naturally-acidic waters from peatlands. Final report.** Shotyk, W. (Environment Canada, Ottawa, Ontario). Feb 1986. 64p. (MICROLOG—87-04577). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The geochemistry of two sphagnum bogs were compared. One was a continental bog underlain by calcareous sediments, the other a maritime bog in a siliceous environment. The stratigraphy of the peats (botanical composition, degree of decomposition), and aspects of their inorganic chemistry (ash content, Na, K, Mg, Ca, Al, Fe, Mn, As, Cr, U, W, Zn) are reported. Redox chemistry was described by measuring CO/sub 2/, CH/sub 4/, total dissolved sulphide, and sulphate in the pore waters. In addition to SO/sub 4// sup 2-/, anions determined by ion chromatography include chloride, oxalate, formate and acetate. In an effort to demonstrate the importance of low molecular weight organic acids on the speciation of dissolved metals, calculations were performed using a computer program. Redox chemistry of bog waters can be further described by measuring the concentrations of individaul redox species of interest. 3 figs., 13 tabs.

10755 (EC—8609) **Impact of peatland drainage waters upon aquatic ecosystems. Final report.** Shotyk, W. (Environment Canada, Ottawa, Ontario). Sep 1986. 77p. (MICROLOG—87-04628). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This study is of the chemistry of drainage waters from mined peatlands in Canada and abroad. An effort has been made to compare the drainage waters of mined versus undisturbed peatland sites. In many of the studies cited, mined and undisturbed peatland waters are compared but emanate from two different mires. Recurring observations are noted. Potential problems associated with peat mining are identified and recommendations for further study are presented. In general, the development of peatlands for ditching, vegetation removal, and dry peat mining has the following effects on peat bog drainage waters: pH and alkalinity increase because ditching releases more alkaline basal peat pore waters and mineral soil water; N and P concentrations increase because drainage accelerates the decomposition of organic matter; Al and Fe concentrations decrease because the waters become less acidic and more oxidizing, and in some cases, peatland drainage has resulted in Hg remobilization.

10756 (MC—850930) **Design and construction of peat slurry pump/macerator.** Mankinen, G.W.; Gelfer, B.Y. (Monenco Consultants Ltd., Rexdale, Ontario (Canada)). 30 Sep 1985. 158p. (MICROLOG—87-04622). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Construction of a new design of peat slurry pump/macerator consisted of the following stages: review of previous designs, materials of construction, and tolerances to develop basic peat slurry mining pump paramenters; proposals from pump manufacturers regarding their interest, capabilities (skills and fabricating) and ideas on basic design requirements, and costs; design and fabrication aspects reviewed in detail and various potential operational problems discussed. A final design review and fabricataion schedule was established. 44 figs., 1 tab.

10757 (MM—860224) **Environmental summary: harvesting and use of peat as an energy source.** Phinney, K.D. (Monenco Maritimes Ltd., Fredericton, New Brunswick (Canada)). 24 Feb 1986. 70p. (MICROLOG—87-04627). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The report provides a review and summary of the potential environmental effects related to the harvesting of peat and its use as a source of thermal energy. Processes for the dewatering, combustion, and conversion of peat into gaseous, liquid and solid fuels are considered. It provides a description of the various processes, the source of potential environmental concerns, waste management methods, and defines the further information and research that is required to enable a more complete understanding of environmental matters related to the use of peat as a source of thermal energy. Mechanical dewatering of peat produces liquid effluents which are coloured and contain elevated concentrations of biochemical and chemical oxygen demands as well as total and ammonia nitrogen. These effluents are amenable to both anaerobic and aerobic biochemical treatment processes but may require additional treatment for the removal of colour, suspended material and refractory organics. Flue gases from the thermal drying of peat contain volatile organics distilled from the peat. Careful selection and well controlled operation of peat combustion furnaces are required to minimize aromatics in the flue gases. 8 figs., 20 tabs.

10758 (MPG—8604) **Peat slurry pumping demonstration project. A joint project by New York State Energy Research and Development Authority and National Research Council of Canada.** (Monenco Peat Group, New York (USA)). Apr 1986. 211p. (MICROLOG—87-04630). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This peat slurry pumping demonstration test included run-in testing of the peat slurry pump on a New York peatland site, where both its mining and pumping performance on peat were confirmed on a drained bog. The project consisted of the following stages: a site selection process to assess suitability for the peat slurry pumping test, a sampling and laboratory testing program to determine

the peat characteristics of the test area, site preparation activities, equipment fabrication, equipment set-up, mining and pumping activities, studies of the degree of maceration, settability and dewaterability of peat slurry samples taken from various locations in the slurry preparation, pumping and pipeline system. 46 figs., 24 tabs.

10759 **(ORF/ECE—P/4454/G) Advanced treatment of peat wastewaters. Revised final report.** McKim, M.P.; Culham, B. (Ontario Research Foundation, Mississauga (Canada). Environmental and Chemical Engineering Div.). Sep 1986. 53p. (MICROLOG—87-04624). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Thermophilic anaerobic digestion of wastewater from thermal processing and dewatering of fuel grade peat by using an expanded bed reactor with granular activated carbon was proposed by Ontario Research Foundation. The peat filtrate was characterized as a deeply coloured, acidic liquid with high concentrations of soluble organic matter and ammonia. Colour removal was considerably better than that experienced with other anaerobic treatment systems which did not employ activated carbon. The useful life of the acitvated carbon was greatly extended over that predicted from standard adsorption isotherm studies. 13 figs., 6 tabs.

10760 **(PB—88-102975/XAB) Demonstration of longwall mining in a steeply dipping coal seam. Research report, September 1977-May 1986.** Kennedy, M.R.; Reschke, L.M. (Snowmass Coal Co., Palisade, CO (USA)). Jan 1987. 83p. NTIS, PC A05/MF A01.

This report describes the demonstration of longwall mining in a seam dipping 27 deg to 34 deg. Equipment was selected on the basis of capability, compatibility, and cost. The longwall equipment operated very well on the steep pitch with an average equipment downtime of 21.9%. Coal handling out by the face was a problem that caused an additional downtime of 19.5%. Development for the panels proved to be the major problem in the economics of longwall mining on a steeply dipping seam. During the first 9 months of operation, the longwall averaged 71.9 tons per man-shift (TPMS) and development averaged 0.6 TPMS. for an overall average of 14.1 TPMS.

10761 **(PB—88-109749/XAB) Three-dimensional shield mechanics. Report of investigations/1987.** Barczak, T.M.; Burton, W.S. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 29p. (BM-RI—9091). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600011.

The report describes research on developing technology to utilize shields as roof-load monitors. Three-dimensional equations of static equilibrium are presented for a generic two-legged longwall shield. The equations are presented in the most general form, assuming a force and moment vector at each reaction by rigid-body analysis of the shield mechanics. The resulting system of equations was found to be indeterminate to a very high degree. A three-dimensional solution to measurement of the resultant reaction on the canopy by the strata activity and shield response required the elimination of several forces or moments that were thought to be nonparticipating or to not significantly affect overall shield mechanics. Required measurements for solution of the equilibrium equations were leg, canopy capsule, and lemniscate link forces. Two-dimensional analysis, which considered forces acting only in the roof-to-floor and face-to-waste plane, was also provided by reduction of the three-dimensional equations.

0140 Combustion

REFER ALSO TO CITATION(S) 10730, 10745, 10748, 11184, 11397, 11398, 11627

10762 **(CONF-870802—34) SO/sub x/-NO/sub x/ control in a staged cyclone coal combustor with limestone injection.** Zauderer, B.; Fleming, E.; Swift, W.M. (Coal Tech Corp., Merion, PA (USA); Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003008/JAW.

From 194. American Chemical Society national meeting; New Orleans, LA, USA (30 Aug 1987).

The results of a preliminary experimental study of SO/sub x/-NO/sub x/ control in a two-stage cyclone coal combustor (2 MW(t)) with limestone injection are presented. The tests were carried out using a finely pulverized West Virginia low-sulfur bituminous coal (0.8% S), an Illinois No. 6 medium-sulfur coal (1.6% S), and an Illinois No. 6 high-sulfur coal (2.7% S). With limestone injection in either the first or second stage of the combustor, SO_2 reductions in excess of 80% were obtained. The sorbent injection tests indicated that the first-stage combustion temperature as influenced by the air/fuel ratio was a major factor in sulfur capture. NO/sub x/ emissions measured at the exit of the second-stage combustor were reduced by up to 55% over those from single-stage combustion. In addition, the benefits of a staged cyclone combustor for NO/sub x/ control were enhanced when the second-stage gas temperature was minimized, either through increasing second-stage air dilution or by maximizing first-stage carbon conversion. 5 refs., 4 figs., 2 tabs.

10763 **(CONF-8710214—3) Condensed and gaseous products chemistry in the combustion and gasification of high-sulfur coal.** Sinha, S.; Natesan, K.; Blander, M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002869/JAW.

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

A recently developed computer program, based on geometric programming, is used to calculate condensed and gaseous products chemistry in the combustion or conversion of high-sulfur Illinois No. 6 coal. Under 30% air-excess and 30% air-deficient conditions, product chemistries were calculated as a function of temperature. For the temperature ranges of 1800 to 1100°K, condensed phases are saturated with solid silica, and the major "Na" and "Cl" bearing gaseous species are NaCl and HCl. The concentration of sulfates (under oxidizing conditions) or sulfides (under reducing conditions) in the silica-saturated molten silicate solutions increases progressively with a decrease in temperature. The liquid condensates appear to be more complex than believed, and "hot corrosion" by silicates could be important.

10764 **(DOE/MC/23249—2502) Kinetic behavior of solid particles in fluidized beds: Solid particle kinetic forces: Quarterly report, April-June 1987.** Kono, H.O.; Huang, C.C. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). Aug 1987. Contract AC21-86MC23249. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001011/JAW.

The tracer particle method has been applied to investigate the effect of bed configuration on the kinetic forces of solid particles in fluidized beds. In general, the experiments show that the kinetic forces of fluidized particles increase with increasing particle size, bed height, and superficial gas velocity in a spouted fluidized bed, a square fluidized bed, and a two-dimensional fluidized bed. However, the kinetic forces in the two dimensional fluidized bed and the square fluidized bed were found to be smaller than those in the circular fluidized bed. Among circular beds the kinetic forces in the spouted fluidized beds were larger than those in the regular circular fluidized bed due to the existence of a jet. A Piezotron force sensor combined with the data acquisition system, using a PC computer, was developed and will be employed to study the force distribution in fluidized beds as a function of time and location.

10765 (DOE/PC/79863—T5, pp 23-32) **Reactivity of whole coals and selected pure maceral fractions.** Crelling, J.C.; Hippo, E.J. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The overall objective of this project is to determine the process response properties of pure single coal maceral fractions in order to predict the behavior of various whole coals of different maceral compositions and rank. Results will establish interrelationships between maceral and whole coal parameters and process response variables, such as maximum charring reactivities and yields, and combustion and gasification reactivity. The TGA was calibrated, and tests of combustion in air and reactivity of chars in 5% oxygen and 95% nitrogen were standardized. In addition, charring conditions were set to match ASTM volatile matter yields. Calibration tests for the reactivity of chars in carbon dioxide were begun. The planned experimental program for combustion tests of whole coals, demineralized whole coals, cesium-soaked coals, and micronized coal were completed, along with some test results for pure vitrinite macerals. 7 refs., 2 figs., 2 tabs.

10766 (DOE/PC/79863—T5, pp 103-109) **Fine-particle coal as a source of energy in small-user applications.** Rajan, S.; Davis, P. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

Tests have been conducted to investigate the influence of air-fuel ratio and resonance frequency on pulse combustor efficiency and emissions, and the results have been reported previously. During the present quarter, a metering and delivery system has been designed to feed dry micronized coal to the 150,000 Btu/h pulse combustor. Major components of the micronized coal feed system have been fabricated, and are being assembled. 3 figs.

10767 (EPRI-CS—5527) **Operations guide for the use of combustion additives in utility boilers: Final report.** Radway, J.E.; Hoffman, M.S. (EnerChem, Inc., Cupertino, CA (USA)). Dec 1987. 362p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920105/JAW.

This report is a comprehensive reference manual explaining how to select, test, and evaluate the performance of fuel additives. It digests and organizes up-to-date information concerning experience with additives from many sources, including: utilities, boiler manufacturers, additive suppliers, instrument and equipment suppliers, research organizations, published literature, and the authors' personal experiences. Emphasized in this report is the need to consider the entire fireside system when investigating possible additive use - from burners to stack - rather than to narrowly address specific problems such as high-temperature corrosion or poor precipitator efficiency. A wide assortment of chemicals (and their forms) for mitigating fireside problems is described. Additive properties and form are related to application equipment, performance, and both positive and negative side effects to the boiler system. Fireside testing techniques are discussed in detail. The report provides guidance on comparing the economic merits of using additives to address fireside problems with mechanical alternatives. Included in the economic guidance is assessment of the potential for additives to extend equipment life, reduce maintenance and operating costs, and increase availability. Specific recommendations on use of additives to resolve problems on both oil- and coal-fired boilers are provided. Case histories and reference tables are included to facilitate use of this reference manual.

10768 (ORNL/Sub—84-00224/01) **A mechanistic study of low-temperature corrosion on materials in the coal combustion environment: Final report.** Haskell, R.W.; Doering, H.vonE.; Le Blanc, O.H.; Luthra, K.L. (General Electric Co., Schenectady, NY (USA)). Aug 1987. Contract AC05-84OR21400. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003683/JAW.

The low-temperature corrosion program arose because of the hot corrosion observed at temperatures as low as 1100°F in the Long-Term Materials Test (LTMT). The LTMT was sponsored by DOE and involved the operation of the pressurized fluidzed bed combustor (PFBC). The low-temperature corrosion program was a two-year research effort to develop an understanding of the low-temperature hot corrosion phenomena observed during the LTMT. The program involved three tasks: (1) an analysis of selected specimens from the LTMT, (2) thermochemical stability calculations on what molten salts were formed to permit hot corrosion at such low temperatures, and (3) operation of burner rig tests which would simulate the LTMT-PFBC conditions and test the conclusions of the thermochemical calculations. The PFBC burned about a 2/1 mixture of coal and dolomite. The combustion gases were cooled by an in-bed exchanger to about 1750°F and then passed through a low-velocity test section where specimens were held at about 1500°F (the gas temperature), 1300°F, and 1100°F, respectively. Gas pressure in the test section was 10 atm. Sulfur concentration calculated as SO_2 was 10^{-3} to 10^{-4} atm. The program has shown that there is an increase in hot corrosion where potassium sulfate is present. This was observed in the LTMT tests. This enhancement will be present in all coal environments. This enhancement has two aspects. One, there is an increase in high-temperature hot corrosion (1400 to 1600°F), because potassium sulfate lowers the melting point of sodium sulfate. Two, potassium sulfate stabilizes the alloy sulfates nickel and cobalt, particularly the latter, and thus substantially reduces the SO_2 pressure required for their formation. Thus, low-temperature hot corrosion (1100 to 1400°F) can occur over a larger range of sulfur levels. These aspects of hot corrosion were demonstrated in tests and examined by thermochemical calculations. 25 refs., 112 figs., 17 tabs.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 10716, 11604

10769 (IEACR—02) **China's potential in international coal trade.** Doyle, G. (International Energy Agency Coal Research, London (UK)). Oct 1987. 94p. International Energy Agency Coal Research, London, England.

The fifth in a series on the major coal-exporting countries, this report examines in detail the potential for coal exports from China. China, the world's number one hard coal producer, supplied only 2.5% of the total traded coal in 1985. This situation will almost certainly change as China is now poised to become a major coal exporter. A survey of China's coal industry is presented, followed by an evaluation of prospects for coal supply, and transport infrastructure, internal energy demand, energy and trade policy, and foreign demand for Chinese coal. The report concludes that China will probably become significantly more important than Colombia as a coal-exporting country. As such, China will be a threat to traditional suppliers. However, the overall growth in the market will be such that any reduction in export volumes of existing exporters will be modest. Perhaps, more importantly for China's competitors, the presence of substantial low-cost supplies from China will put downward pressure on prices and will act to reduce the call upon high-cost marginal suppliers. 55 refs., 19 figs., 46 tabs.

0160 Health And Safety

10770 (PB—88-102843/XAB) **Reactivity of coal and the prevention of spontaneous heating in coal in stockpiles in South Africa. First supplement.** Coetzee, S.D. (National Inst. for Coal Research, Pretoria (South Africa)). 1985. 56p. (COAL—8507). NTIS, PC E06/MF E06.

See also PB—86-150380; North American Continent sales only.

Coalification is a process in which molecular order is being derived from disorder. Quantum-mechanical energy levels are initiated which increase in energy with rise in overburden pressure, but on erosion or removal of pressure the surplus energy is spent spontaneously. On being mined, the coalification process reverts to one in which disorder due to oxidation becomes predominant. This characteristic of coal gives rise to the fact that all coal components become susceptible to spontaneous heating. The prevention of spontaneous heating is based on the preclusion of oxygen from the coal

and the maintenance of an inert atmosphere within the stockpile. The method recommended for stockpiling is discussed, and the tests for spontaneous heating as well as the quality of the atmosphere within the stockpile are described.

10771 **(PB—88-108998/XAB) Case-control study of reasons for unusual radiological changes of pneumoconiosis among individual mine workers. Final report, January 1982-December 1986.** Robertson, A.; Hurley, J.F.; Brown, P.W.; Collins, H.P.R.; Dodgson, J. (Institute of Occupational Medicine, Edinburgh (UK)). Jul 1987. 139p. (TM—87/11). NTIS, PC E07/MF E07.

The objective of the study was to investigate the environmental factors associated with rapid progression of coalworkers' simple pneumoconiosis (CWSP) and progressive massive fibrosis (PMF). A second, subsidiary aim was to describe the occurrence of rapid progression and PMF throughout Britain. The research was carried out in two separate but related phases. In the first, the distributions of new occurrences of rapid progression of CWSP and PMF throughout Britain in the 1970s were investigated. Results refer to almost 100,000 miners, using data collected in the Periodic X-ray Scheme (PXR) of National Coal Board (NCB)* Medical Services. A more intensive case-control study of some of these men was then undertaken to investigate the environmental factors associated with these radiological changes. The results from the first phase of the study confirmed that the risks of PMF vary markedly with NCB Area within Britain. Highest risks were found in South Wales and North East England. There is a clear-cut increase in risks of PMF with increasing category of CWSP classified according to the full 12-point ILO scale. However, because of relative numbers at risk more than half the cases were found against a background of category 0 and 1 of simple pneumoconiosis. Risks clearly increased with age.

10772 **Evaluation of an improved fiber optics luminescence skin monitor with background correction.** Vo-Dinh, T. (Oak Ridge National Lab., TN). *American Industrial Hygiene Association Journal;* 48: No. 6, 594-598(Jun 1987). Contract AC05-84OR21400.

An improved version of a fiber optics luminescence monitor, the prototype luminoscope II, is evaluated for in situ quantitative measurements. The instrument was developed to detect traces of luminescing organic contaminants on skin. An electronic background-nulling system was design and incorporated into the instrument to compensate for various skin background emissions. A dose-response curve for a coal liquid spotted on mouse skin was established. The results illustrated the usefulness of the instrument for in vivo detection of organic materials on laboratory mouse skin.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 10747, 10769

10773 **(DOE/FE—0094) Summary proceedings: Public meetings for views and comments on the conduct of the Innovative Clean Coal Technology Solicitation.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC). Nov 1987. 185p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003238/JAW.

Four public meetings were convened by the Department of Energy (DOE) in August and September of 1987 in order to obtain views, comments, and recommendations with regard to the Innovative Clean Coal Technology (ICCT) solicitation. Brief descriptions are provided of the background to the ICCT solicitation and the public meetings, and how the meetings were conducted. Subsequent chapters of this report present the discussions that ensued at each of the meetings, and the views, recommendations, and concerns that were expressed by attendees. Finally, the report includes a compilation of the written comments that were received, and, in the appendix, a list of the organizations that were represented at the public meetings.

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 10775

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 10778, 11643, 12188

10774 **(CIM—87/165) The Devran/Shell oil mining project.** Cowan, J.; O'Gorman, G.; Hemphill, D. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1987. 18p. (CONF-8705228—). Canadian Institute of Mining and Metallurgy, 400 - 1130 Sherbrooke Street, W., Montreal, P.Q., Canada H3A 2M8; $5.00 CAN.

From 89. annual general meeting of CIM; Toronto, Canada (3 May 1987).

This paper describes the historical development of the Devran/Shell oil mining project located near Sarnia, Ontario. The Sarnia area boasts North America's first oil well discovery in 1857. During the 1920's, Leo Ranney developed and patented the Ranney method of oil recovery, a variation of which is being used at the Sarnia Project. The method included sinking a shaft down to the oil bearing horizon (pay zone), establishing a drilling station within the pay zone, and drilling long horizontal holes in a radiating wagon wheel pattern into the oil zone. This method provides much greater reservoir exposure than conventional vertical drilling, with recoveries potentially greater than by conventional means. As well, the method utilizes only 4-5 surface acres out of the more than 600 acres in the Production Unit A. 8 figs.

10775 **(CONF-8708188—1) Upper Devonian-Tournaisian facies and oil resources of the Russian craton's eastern margin.** Ulmishek, G.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003026/JAW.

From 2. international Devonian symposium; Calgary, Canada (17 Aug 1987).

Upper Devonian-Tournaisian facies on the Russian craton's eastern margin indicate deposition in two distinct paleomorphic environments: bathimetrically expressed basins and shallow platforms. Shallow-water carbonate sedimentation persisted on the platforms, and black, thin-bedded, organic-rich shales and limestones of the Domanik facies were deposited in stagnant basins that stretched more than 2000 km from the Arctic Ocean to the Caspian Sea. Intermittently introduced clastic material and detrital carbonates formed progradational shelves. Barrier reefs along platform edges, atolls and reef mounds on basin margins, and smaller patch reefs on platforms were abundant. The basins were finally filled with Tournaisian (in the Timan-Pechora province) or basal Visean (in the Volga-Ural province) clastics. The North Caspian deep-water basin survived until the end of Early Permian time when it was filled with a thick salt formation. The organic-rich Domanik facies is the major source rock in the Volga-Ural, Timam-Pechora, and North Caspian petroleum provinces. About one-third of oil reserves occurs predominantly in structural traps in Middle Devonian-lower Frasnian clastics that directly underlie Domanik rocks. Most of the remaining two-thirds is found in reefs, especially in drape structures over the reefs in Tournaisian carbonates and basal Visean clastics. 61 refs., 16 figs.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 10774, 10889, 10890, 12191

10776 (AU—860303) Steam injection experiments in a scaled physical model. Final report. Farouq Ali, S.M. (Alberta Univ., Edmonton (Canada)). 3 Mar 1986. 239p. (MICROLOG—86-01856). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This was a study of steam injection processes and comprised of experiments conducted in a scaled physical model, under a wide variety of conditions. A large part of the work was devoted to the design and construction of the scaled model apparatus used to conduct the steam injection experiments. The apparatus was designed to represent one-quarter of an eight hectare (twenty acre) five-spot pattern and was scaled based upon low pressure scaleing criteria. A number of steamflood experiments were carried out to show the use of the apparatus and the efficacy of the processes under investigation. The main target of the experimental studies was the Aberfeldy heavy oil reservoir of the Lloydminster area. To examine the recovery potential of this reservoir, several types of runs were conducted, including continuous steamfloods in a homogeneous pack, a continuous steamflood in a bottom water pack, slug runs on a homogeneous pack, and a steamflood following a waterflood. Bottom water had a very detrimental effect on the efficiency of a conventional steamflood, with oil recovery in one run being one-tenth of the recovery experienced in the contiuous steamflood experiments. The possibility of steamflooding a conventional oil reservoir to improve the ultimate oil recovery, appears to warrant further investigation. 83 figs., 20 tabs.

10777 (DGMK—345) Microbial metabolism in oil fields and production plants. Final report. Naeveke, R.; Graff, M. (Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.)). Apr 1987. 134p. (In German). Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.).

In laboratory experiments and by attempts to produce enrichment cultures of bacteria from samples of oil deposits the influence of the ecological parameters salt concentration, temperature and hydrostatic pressure on the establishment of microbial dissimilatory sulfate reduction were looked into. In situ sulfate reduction in untampered deposits would appear to be very unlikely. But through the influence of secondary or tertiary operations (even in deep deposits) bacterial H/sub 2/S production may be initiated. In the type of oil deposit investigated the participation of an autochthonous bacterial biocenosis can almost certainly be ruled out. On the question of the availability of energy and nutrient sources and of the terminal electron acceptor sulfate, it could be shown that most deposits contained sufficient ammonium and sulfate to support dissimilatory sulfate reduction, while phosphate appeared often to be a limiting factor. In addition it is shown that the degradation of components from natural deposits is of no significance. Some oil field chemicals, on the other hand, provide good sources of energy and nutrients at whose expense, through a syntrophism between sulfate reducing and non sulfate reducing bacteria, dissimilatory sulfate reduction can occur. Other oil field chemicals may provide sulfate or phosphate. The effects of these circumstances on practical operations are discussed. With 9 figs., 39 tabs..

10778 (DOE/BC/14000—1) Primary and secondary recovery in the Sho-Vel-Tum oilfield, Oklahoma: Topical report. Johnson, H.R.; Biglarbigi, K.; Schmidt, L.; Ray, R.M.; Kyser, S.C. (Lewin and Associates, Inc., Washington, DC (USA)). Oct 1987. Contract AC19-86BC14000. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87001262/JAW.

This study was undertaken as part of a comprehensive review of the potential for enhanced oil recovery in Oklahoma. Due to the past production and future potential production from the Sho-Vel-Tum oilfield, the largest producing field in the State of Oklahoma and the eleventh largest in the United States (15), it was subjected to the detailed analyses reported in this document. The original oil in place at Sho-Vel-Tum is estimated in this study to be 3.237 billion barrels of oil. Of this total, 1.235 billion barrels have been produced from the field through 1984 by primary and secondary (waterflood) applications, while reserves are estimated to be an additional 169 million barrels. By subtraction, 1.833 billion barrels still remain as a target for future development, including enhanced oil recovery. 17 refs., 10 figs., 4 tabs.

10779 (DOE-OTH—86-260) Well control when drilling with oil-based mud. Recent British experience in deep wells. (Department of Energy, London (UK). Operations and Safety Branch). 1986. 34p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks LS23 7BQ.

Based on a report by E.B. Turner.

A report is presented as part of a programme undertaken by the Department of Energy to improve safety when drilling deep high pressure wells on the United Kingdom Continental Shelf from floating rigs. The report contains sections on a general review of typical incidents including swab-induced kicks and kicks when drilling, the relationship between the oil-based mud (OBM) and the reservoir fluid, rig equipment for handling gas, the types of kick, their detection and handling and areas of study and further training. The conclusions and recommendations for each section are presented.

10780 (ERCB/C—ERCB/ST/87/10) Reservoir performance charts: oil pools. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). Dec 1986. 545p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $75.00 CAN.

This report provides data from 1972 to 1986 for 452 pools. Data included are average gas-oil ratio, average water-oil ratio, static bottom hole pressure, number of wells capable of production, daily and cumulative oil production, daily and cumulative water injection, and daily and cumulative gas injection. This publication also includes Alberta daily average oil production from 1950 to 1986 charted by month.

10781 (ERCB/C—ERCB/ST/87/46) Oil and gas well blowout report: events of 1986. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). Jul 1987. 97p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $10.00 CAN.

This report provides information about blowouts: a summary for each blowout that occurred in 1986 is provided as well as an historical summary for the past ten years. The report also contains statistical information on wells licensed and drilled, drilling rig inspections and other events that occur while drilling, servicing and operating wells. Only 2 blowouts occurred while drilling 4,495 wells in 1986. There were 16 blowouts among approximately 79,000 active wells. The Board made 1980 inspections of drilling rigs, including 130 inspections of 34 critical sour wells. Details and comments regarding these operations are provided.

10782 (NMRDI—2-74-4326) Improvement of CO_2 flood performance: Second annual report. Heller, J.P.; Kovarik, F.S.; Taber, J.J.; Bretz, R.E.; Dandge, D.K.; Huh, D.G.; Lee, H.O.; Taylor, M.A. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Oct 1987. 251p. NTIS, PC A12/MF A01 - NMRDI Suite M, 457 Washington S.E., Albuquerque, NM 87108. Order Number DE88900138/JAW.

This report gives detailed descriptions of progress in research which is divided into three major areas. Area I concerns the phase behavior and fluid properties of CO_2-hydrocarbon mixtures. A crystal viscometer has been developed and validated using both pure component and multiple component CO_2-hydrocarbon systems. The newly modified Continuous Phase Equilibrium apparatus now has a temperature and pressure range of $T > 250 +- 0.1°F$ and $P < 5000$ psi, respectively, and the capability of generating simultaneous data on density, viscosity, and composition of phases at reservoir conditions. Simultaneous viscosity, density, and composition data are presented for two CO_2/synthetic oil and one CO_2/crude oil system. In Area II, the added complexity of the porous rock is considered in its effect on the mixing processes during CO_2

displacements. A new low temperature CO_2 coreflood has been designed and constructed, and an initial suite of experiments run. We present some recent work with the high pressure flow visualization experiments where we demonstrate how stable CO_2 foam can block high permeability streaks, thereby directing CO_2 flow into the low permeability matrix and recovering trapped oil. In Area III, there has been good progress in the work to develop field-usable mobility control additives for CO_2. Most types of surfactant have been tested for suitability in stabilizing CO_2-foam in reservoirs, and further developments have been made in measurement procedures for the detailed tests required to assess particular combinations of reservoir rock, brine and surfactant. The second possibility for CO_2 mobility control, which has been pioneered by us, is to develop "direct thickeners" that form polymeric solutions in dense CO_2. 55 refs., 104 figs., 22 tabs.

10783 **(NP—8751235) Investigation of the effect of hot steam on petroleum and quartz sands containing sulfur.** Radwitz, T. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Tiefbohrtechnik, Erdoel- und Erdgasgewinnung). Mar 1987. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751235/JAW.

Laboratory experiments were carried out in the context of this work, in order to examine the effect of the thermal treatment of crude oil on the formation of gaseous reaction products and the resistance of quartz sands. Various crude oils were subjected to a pure thermolysis and aquathermolysis. The temperatures were in the range of 200degC to 350degC. The investigations were carried out at atmospheric pressure and in high pressure conditions. The high pressure experiments were carried out in a closed system in static and in dynamic flooding conditions. A new type of flooding apparatus was developed for this purpose, which permits the use of pressures of 12 MPa and temperatures up to 350degC. By using two different tensides, the effect of substances active at boundary surfaces on gas formation was examined. The reaction gases formed were detected by gas chromatography and changes in their concentrations were determined depending on time and temperature. Apart from forming distillates, the sulfur content in crude oil, distillate and in the residual products is measured by X-ray fluorescence analysis. In order to judge the changes in flow properties due to the distillation effect, the viscosities of the liquid components were measured. The assessment of the thermal/chemical resistance of quartz sands to the effect of hot steam was done in a high pressure steaming plant.

10784 **(NP—8751236) Investigation of filter cakes from borehole flushing.** Hartmann, A. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Tiefbohrtechnik, Erdoel- und Erdgasgewinnung). Mar 1987. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751236/JAW.

In the context of this work, a preparation technique suitable for REM was developed for examining the filter cake structure. The process can be characterized by the following key words: Shock freezing, freeze fracture technique, freeze drying. The filter cake structure from three freshwater and three salt water based flushings was examined by this method. The main feature was the effect of flushing pre-loading and filtration conditions on the filter cake structure. The REM photographs of the filter cake structure were compared with the associated filtration curves and the rheological parameters were interpreted. Apart form these possibilities of correlation offered by the experimental program, the preparation technique developed in the context of this work also offers a new opening for the clearing up of questions regarding flushing.

10785 **(NP—8751237) Investigation of changes of rheology of borehole flushing dependent on temperature.** Poege, S. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Tiefbohrtechnik, Erdoel- und Erdgasgewinnung). Apr 1987. 109p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751237/JAW.

The electrolyte- and temperature-related damage of water-based borehole flushing was examined using electron microscopy, X-ray diffractometer analysis and gel permeation chromatography. Reversible and irreversible changes of the flushing properties were measured as criteria for assessing flushing damage. In order to find the cause, the damage of individual flushing components was determined by chemical and thermal loading. The thermal decomposition of the flushing components was related to the change of flushing properties.

10786 **(WPC—8307) Enhanced heavy oil recovery problems, incentives and priorities.** (Winestock Petroleum Consulting Ltd., Edmonton, Alberta (Canada)). Jul 1983. 224p. (MICROLOG—84-3978). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Enhanced oil recovery (EOR) processes represent an important potential means of increasing Canada's recoverable reserve. Efforts to develop broadly applicable EOR techniques have met with mixed success. In many instances, this has been due to low levels of recovery. Paricularly in applications where flushing efficiency is high, such as miscible flooding and thermal recovery processes, these low recovery efficiencies are indicative of poor sweep efficiency (conformance). Within the past two to five years, there has been some increase in emphasis on improving conformance. For the most part, this effort has been directed towards both laboratory and field pilot experiments involving divertants in the form of foams. There is also potential for improving conformance through other approaches such as infill drilling, the use of horizontal wells, prudent selection of completion intervals and well operating strategies. These alternatives merit increased investigation. This study reviews enhanced oil recovery technology from the viewpoint of potential for conformance improvement. Salient approaches which have been the subject of varying degrees of evaluation are described, and their impact or potental impact on conformance is discussed. Finally, a brief summary of enhanced oil recovery project activity in Canada and the United States is presented. 8 figs., 23 tabs.

0204 Processing

REFER ALSO TO CITATION(S) 10815, 10899

10787 **(DOE/CE/15303—T2) Feasibility of application of Thayer method to crude oil distillation.** Prengle, H.W. Jr.; Althaus, Y.E. (Houston Univ., TX (USA). Dept. of Chemical Engineering). 31 Jul 1987. Contract FG01-87CE15303. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88000377/JAW.

The purpose of this report is to present the results of an evaluation of Victor R. Thayer's invention: "Process and Apparatus for reducing the Energy Required to Separate Liquids by Distillation", applied to crude oil distillation. In brief, Thayer claims that given a side draw-off pump-around on a distillation column for energy conservation, there would be a significant cost advantage by using on-tray heat exchange rather than external exchange. Preliminary cost estimates were made: external case, $1,091,000 +- 15%; on-tray case, $882,200 +- 20%; both values falling within the estimated uncertainity limits. Therefore, and coupled with much greated annual maintenance costs, a significant cost advantage of the on-tray system was not verified. The primary conclusion of the evaluation was that, in our opinion, the Thayer method will not be used for retrofit of crude oil distillation units, and probably will not be used in the design of new crude units. 12 refs.

10788 **(GULF/C—850325) A study of incorporating heavy oil and synthetic crude residua into fluid catalytic cracking feedstocks. Final report.** (Gulf Oil Canada Ltd., Sheridan Park, Ontario. Research and Development Dept.). 25 Mar 1987. 90p. (MICROLOG—85-5954). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The overall objective is to evaluate the viability of producing tansportation fuels from heavy oil and synthetic crude residua by incorporating these materials into fluid catalytic cracking feedstocks. Yield data obtained by microactivity testing along with established modelling procedures allow an assessment of these feed-

stocks in the fluid catalytic cracking unit operation. This project establishes microactivity test yield data for residua with metal-tolerant catalysts, determines the effect of metals and metal passivators on yields with these catalysts, and assesses through modelling whether these feedstocks, catalysts and passivators lead to a viable fluid catalytic cracking operation.

10789 **(PB—88-116520/XAB) Methods for the analysis of SO_2, SO_3 and H_2S in flue gas and the calculation of the acid dew point.** Albertyn, C.H. (Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group). Feb 1986. 26p. (CSIR-CENG—600). NTIS, PC E05/MF E05.

North American Continent sales only.

Methods are given for the analysis of SO_2, SO_3, and H_2S in flue gas. Two methods are described for the determination of SO_3. The method to be used depends on whether or not H_2S is present in the gas stream. An equation for the calculation of acid dew point is given as well.

0205 Products And By-products

REFER ALSO TO CITATION(S) 10805

10790 **(AD-A—184967/8/XAB) Study of electrostatic modulation of fuel sprays to enhance combustion performance in an aviation gas turbine. Master's thesis.** Manning, W.W. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1987. 104p. NTIS, PC A06/MF A01.

The influence of electrostatic and electrohydrodynamic charging on hydrocarbon fuel-spray patterns and droplet atomization was investigated. Research was performed in a combustion environment with an Allison T-56 combustor liner and an unmodified pressure-jet atomizer fuel nozzle. High-voltage probes and a variable-geometry probe-insertion device were developed to assess the effectiveness of probe type and location on fuel-spray modification and modulation. Exhaust-gas temperatures and temperature profiles were measured to determine changes in the combustor's thermal profile and combustion efficiency. JP-4, JET-A and Number-2 Diesel fuels were tested to analyze electrically-assisted atomization effectiveness relative to off-design fuel performance.

10791 **(AD-A—184968/6/XAB) Experimental investigation of the igaition and flammability limits of various hydrocarbon fuels in a two-dimensional solid-fuel ramjet. Master's thesis.** Wooldridge, R.C. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1987. 43p. NTIS, PC A03/MF A01.

An experimental investigation was conducted to study the effects of inlet step height on ignition and flammability limits and recirculation-zone and boundary-layer combustion phenomena of various hydrocarbon fuels. A windowed two-dimensional solid-fuel ramjet (SFRJ) was utilized. Hydrocarbon fuels were burned under conditions similar to the actual flight were studied using a variable geometry inlet, an automatic data acquisition system, and high speed motion pictures of the interior of the combustion chamber at the recirculation zone and the boundary layer development region. Data was obtained at a mass flux of 0.2 lbm/in2-sec at a nominal air inlet temperature of 1000 R with pressures ranging from 100 to 150 psia.

10792 **(PB—88-112073/XAB) Influence of fuel sulfur on fuel nitrogen oxidation mechanisms.** Wendt, J.O.L.; Morcomb, J.T.; Corley, T.L. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). 1979. 10p. NTIS, PC A02/MF A01.

This paper discusses laboratory premixed flat-flame studies showing that, under fuel-rich conditions, fuel sulfur can have a radical influence on fuel NO formation mechanisms. Both enhancements and apparent inhibition of fuel NO were observed, depending on the equivalence ratio and the residence time at which the measurement was made. The effect of sulfur on prompt NO was similar. This first-order effect was shown to manifest itself in a significant increase in NOx emissions when a fuel containing chemically bound nitrogen is burned with sulfur in an axial (low swirl) turbulent diffusion flame. Under these conditions, in which local hot fuel environments dominate, fuel oils containing both nitrogen and sulfur are likely to give higher NO emissions than those containing little sulfur. Likewise, prompt NO mechanisms can be significant for thermal NO, and enhancement thereof by SO_2 in the fuel can greatly influence resultant thermal NO emissions.

10793 **(PB—88-120050/XAB) Sulfur-extended asphalt pavement: a three-year progress report. Final report.** Van Bramer, T.F. (New York State Dept. of Transportation, Albany (USA). Engineering Research and Development Bureau). Oct 1986. 22p. (RR—136). NTIS, PC A03/MF A01.

See also PB—83-205971.

This report documents post-construction performance of a sulfur-extended asphalt (SEA) pavement and a conventional pavement used as a control, monitored over a 3-year period. The SEA pavement used 30% sulfur by total weight of the binder. Both pavements were placed under New York State specifications during the summer of 1980 on Rtes 118 and 202 in Westchester County, New York. After 3 years, overall condition of both the SEA and control pavements was satisfactory. The two did not differ significantly in deflection, rutting, friction, or aggregate degradation. Data obtained from analysis of pavement cores showed that the stability of the SEA mix was equal to or higher than that of the control at all ages. Similarly, its resilient modulus was greater at all ages and temperatures. Although tensile-strength ratios measured for both mixes indicated a potential for stripping, virtually non was observed in any of the field cores for either pavement at an age.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 10780, 11598, 11601, 11640, 11643

10794 **(ERCB/C—ERCB/ST/87/17) Alberta oil and gas industry: annual statistics, 1986.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). Jun 1987. 109p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $15.00 CAN.

This report tabulates the annual statistics for 1986 for Alberta's petroleum and natural gas activity. Supply and disposition of crude oil, natural gas, NGL mixes, ethane and butane are presented for 1986 as well as an historical overview from 1977 to 1986. Well counts and drilling activity are also summarized.

10795 **(NP—8750986) MWV annual report 1986.** (Mineraloelwirtschaftsverband e.V., Hamburg (Germany, F.R.)). 1987. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750986/JAW.

After a report on the situation of the mineral oil industry, the role of mineral oil in the power industry is reviewed. Information is given on mineral oil supplies in West Germany, mineral oil sales, environmental protection, as well as legal and technical aspects of mineral oil. The appendix of tables contains detailed figures on the major development lines and structures of mineral oil supply and sales.

0208 Waste Management

REFER ALSO TO CITATION(S) 10711

10796 **(PB—88-111752/XAB) Composition and management of used oil generated in the United States. Appendix. Final report.** (Franklin Associates, Prarie Village, KS (USA)). Sep 1984. 195p. NTIS, PC A09/MF A01.

See also PB—85-180297.

This document is an appendix to the report entitled Composition and Management of Used Oil Generated in the United States which characterizes used oil generation, management, and composition in the United States in 1983. The study was carried out to provide the U.S. Environmental Protection Agency with the needed background information to develop the most-appropriate used-oil regulations and to provide a framework for assessing the risks and benefits of alternative regulatory options. The document contains

four appendices: (A) Analytical Data for Waste Oil Samples; (B) Data Base for Contamination of Residues from Waste Oil Processing and Re-refining; (C) Methodology and References for Used Oil Flow Description; and (D) Alternative Methodology to Calculate Mean Concentration of Hazardous Constituents in Used Oil.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 12469, 12538, 12542, 12578, 12579, 12580, 12581

10797 (CONF-8710210—3) A new technology for pipeline installation in wetlands. Johnson, D.O.; Carter, R.P.; Gaynor, A.J. (Argonne National Lab., IL (USA); Gas Research Inst., Chicago, IL (USA)). 1987. Contract W-31109-ENG-38. 4p. NTIS, PC A02; 3; GPO Dep. Order Number DE88002880/JAW.

From 4. symposium on environmental concerns in rights-of-way management; Indianapolis, IN, USA (25 Oct 1987).

One technique, known as the sled or plow, is being developed. In monitoring one crossing, we found that suspended sediment loads were reduced by 50% from those associated with a conventional crossing and that costs were reduced by approximately 25%. These reductions suggest that a larger-scale sled may have considerable potential for installing larger-diameter pipelines over greater distances, as well as for application in wetland and barrier island environments. We are obtaining performance and cost data for the sled technique, through model- and full-scale laboratory and field testing, to quantify the technique's potential and define its limitations. 3 refs.

10798 (DGMK—335) Fate and effects of crude oil, dispersants, and chemically dispersed oil in a Wadden Sea ecosystem: Chemical analyses. Farke, H.; Theobald, N. (Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.); Deutsches Hydrographisches Inst. (DHI), Hamburg (Germany, F.R.)). Mar 1987. 64p. (In German). Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.).

Field experiments with mesocosms (Bremerhaven Caissons) show the fate and effects of chemically and mechanically dispersed crude oil and dispersants on a Wadden Sea ecosystem. Dispersed oil and the dispersant were added to the incoming tide. Depending on the experiment the oil concentrations in the water were between 2 ppm and 40 ppm. The experiments show no difference between chemically and mechanically dispersed oil in respect of oil accumulation at the sediment surface, and penetration and residence times of the oil in the sediment. Oil concentrations only increase at the sediment surface, penetration into deeper sediment layers is only poor. The residence time of the oil is short. 90 days after the end of the oil additions measurable oil concentrations in the sediment were only found in the experiment with 40 ppm oil. 18 figs., 5 tabs., 10 refs..

10799 (DOE/PO/60004—2) Level II Cultural Resource investigation for the Texoma Distribution Enhancements project, Cameron and Calcasieu Parishes, Louisiana: Final report. LeeDecker, C.H.; Holland, C.C. (Berger, Barnard and Thomas Engineering, Inc., Baton Rouge, LA (USA)). Oct 1987. Contract AC96-85PO60004. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88002383/JAW.

A Level II Cultural Resource Survey was completed for the Texoma Distribution Enhancements project, located in Cameron and Calcasieu Parishes, Louisiana. The 13-mile pipeline extends from Strategic Petroleum Reserve No. 3 to a terminus near Vincent Landing. Located in Louisiana's southwest coastal zone, the pipeline will traverse extensive marsh lands as well as upland prairie terrace areas. Present land use within the project area consists primarily of undeveloped marsh land and cattle range. The study methods included background research, intensive pedestrian survey with systematic shovel testing, a boat survey, and laboratory analysis of recovered artifact collections. One historic site, 16CU205, was identified during the field survey, and it was tested for National Register eligibility. The site is assignable to the Industrialization and Modernization (1890-1940) Cultural Unit. Archaeological testing indicates that it is a rural residence or farmstead, with a house and one outbuilding within the proposed right-of-way. The site lacks significant historical association and sufficient archaeological integrity to merit inclusion on the National Register of Historic Places. Four standing structures were also identified during the field survey. The structures are agricultural outbuildings, less than 40 years in age, that possess no architectural distinction or historical association. They have been documented photographically and by scaled plan drawings, but do not merit additional study prior to their destruction. 24 refs., 15 figs., 3 tabs.

10800 (EC/NS—EE/90) A study of factors influencing oil submergence. (Environment Canada, Dartmouth, Nova Scotia. Conservation and Protection). May 1987. 83p. (MICROLOG—87-04928). Marine Environment Protection Branch, Conservation and Protection, Environment Canada, Dartmouth, N.S., Canada B2Y 2N6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A series of experiments is described elucidating the factors which cause oil from a spilled slick to break up into drops, or pans, and subsequently become partially submerged and less detectable on the ocean surface. The experiments included studies of the break up of a slick on prolonged weathering on a turbulent water surface in the laboratory and studies of the submergence behaviour of simulated oil masses and simulated oil drops. The results are discussed and a tentative model proposed. It is suggested that the conventional concept of oil existing on the water surface primarily as a continuous slick is often erroneous and that substantial quantities of oil may exist as discrete masses varying in size distributed on and under the water surface. An explanation is proposed to account for this behaviour. 26 figs., 8 tabs.

10801 (EC/RRETC—EE/89) Field observations of stranded oil in the Strait of Magellan, Chile 12 1/2 years after the "Metula" spill. Owens, E.H.; Robson, W. (Environment Canada, Ottawa, Ontario. River Road Environmental Technology Centre). May 1987. vp. (MICROLOG—87-04929). Environmental Protection Programs Directorate, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This spill of light Arabian crude in August 1974 was then the largest oil spill from a tanker and was not contained or dispersed, nor were shoreline cleanup measures implemented. A coastal field survey was carried out in January 1987 to make observations on any remaining stranded oil and to collect samples for subsequent total hydrocarbon and gas chromatographic analyses. The results would then be compared with the data obtained from the BIOS experiment where a nearshore release of Lagomedio crude similarly was allowed to stand and degrade naturally. The coasts affected by the "Metula" spill, in the Strait of Magellan, Chile, exhibited extensive asphalt pavements. This report compares the observations from this site visit to the "Metula" area 12 1/2 years after the spill with those from the BIOS experiment over a 4 year period.

10802 (OCS/EIS/EA/MMS—87-0110-Vol.1) Chukchi Sea Oil and Gas Lease Sale 109: Alaska Outer Continental Shelf: Final Environmental Impact Statement, Volume 1. (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Nov 1987. 565p. Minerals Management Service, P.O. Box 101159, Anchorage, AL 99510. Order Number TI88900185/JAW.

This environmental impact statement (EIS) discusses a proposal for oil and gas leasing in the Chukchi Sea Planning Area, analyzes its potential effects on the environment, describes alternatives to the proposal, presents major issues determined through the scoping process and through staff analyses, and describes potential mitigating measures. 75 figs., 54 tabs.

10803 **(PB--87-916410/XAB) Marine accident report - grounding of the Panamanian tankship GRAND EAGLE in the Delaware River near Marcus Hook, Pennsylvania, September 28, 1985.** (National Transportation Safety Board, Washington, DC (USA). Bureau of Accident Investigation). 14 Oct 1987. 22p. (NTSB/MAR—87/10). NTIS, PC A03/MF A01.

The National Transportation Safety Board determined that the probable cause of the grounding of the Panamanian tankship GRAND EAGLE was the loss of steerageway in a restricted channel when the main engine failed to start after the inadequately supported main diesel control-air tubing fractured due to vibration fatigue. Contributing to the grounding was the lack of an adequate control-air, low-pressure alarm which would have alerted the engineers of a critical drop in control-air pressure and the failure of the engineers to immediately notify the master of their inability to start the main engine.

10804 **(PB—88-102892/XAB) Sampling oil-water mixtures at OHMSETT (Oil and Hazardous Materials Simulated Environmental Test Tank). Final report.** Borst, M. (Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ (USA)). Sep 1987. 39p. NTIS, PC A03/MF A01.

This report describes procedures developed at the Oil and Hazardous Material Simulated Environmental Test Tank (OHMSETT) for sampling oil and water mixtures. Two procedures for sampling in containers are discussed: grab and stratified sampling. Both of these techniques require stripping free-standing water from the container bottom. The grab-sample technique requires that the remaining fluids be thoroughly mixed before immersing a bottle through the resulting homogeneous emulsion. The stratified-sampling procedure uses a sample thief to capture a segmented cross section of the remaining fluids. Two procedures for sampling flowing fluids were also tested. The two sampling tubes tested were installed immediately downstream of a series of static mixers and a centrifugal pump. The sampling ports were a simple slotted tube and a pilot-shaped tube.

10805 **(PB—88-108188/XAB) Survey of exposures to gasoline vapor.** Coker, D.T.; Christian, F.; Claydon, M.F.; Irvine, D.; Portail, C. (Concawe, The Hague (Netherlands)). 1987. 48p. (CONCAWE—4/87). NTIS, PC E03/MF A01.

The report presents data on 540 personal gasoline-vapor exposure measurements collected in 13 European countries by an industrial hygiene task force during 1984 and 1985 and stored in a CONCAWE computer database. Gasoline-vapor exposures are quantified and characterized for up to 150 individual components for workers in 15 job groups involved in the manufacture and distribution of motor gasoline. A statistical analysis of exposures to total hydrocarbons is also presented. The report also discusses the assessment of exposure data against established limits for some individual components and gasoline or mixed hydrocarbon vapors.

10806 **(PB—88-109004/XAB) Carcinogenicity of Kevlar aramid pulp following intraperitoneal injection into rats. Final report.** Davis, J.M.G. (Institute of Occupational Medicine, Edinburgh (UK)). Jun 1987. 36p. (TM—87/12). NTIS, PC E05/MF E05.

Injection studies were undertaken with laboratory rats and a preparation of the disaggregated filaments of Kevlar pulp. Standard Kevlar pulp was subjected to violent disaggregation in Dulbecco's phosphate buffered saline using the cavitation forces generated by a turreted tissue homogenizer. Kevlar was administered to rats by a single intraperitoneal injection at three dose levels, 25, 2.5, and 0.25mg. These doses were injected into groups of 32, 32, and 48 animals respectively. Histological examination of peritoneal tissues from rats taken at varying dates after Kevlar injection demonstrated that the cellular reaction to Kevlar fibrils is very vigorous. It is concluded that the Kevlar preparation used in these studies possessed a low but definite carcinogenic potential. Airborn fibers would on average be finer than the disaggregated material used in the study and thus, more carcinogenic. It is, therefore, important that the levels of Kevlar in the factory atmosphere should be carefully monitored and steps taken to reduce exposure to airborn Kevlar to the lowest possible levels.

10807 **(PB—88-111745/XAB) Environmental characterization and biological utilization of the North Aleutian Shelf nearshore zone. Final report.** Truett, J.C.; Craig, P.; Thomson, D.; Troy, D.M.; Johnson, S.R. (LGL Ecological Research Associates, Inc., Bryan, TX (USA)). Jul 1987. 560p. NTIS, PC A24/MF A01.

This report uses both historical and new data to describe the distribution and abundances of important species in the area of study and the physical and trophic factors that appear to influence these variables. Vulnerabilities of the important species to OCS oil and gas activities are addressed, and conclusions as to potential effects of OCS activities are drawn. Deeper parts (>20m) of the study area appear to be similar in structure and function to the middle shelf domain beyond 50m depth. There are large annual variations in the distribution and abundances of many species; however, there are greater diversity and abundance of most species in the spring and summer than in the fall and winter.

10808 **(PB—88-116421/XAB) Integration of suspended-particulate matter and oil-transportation study. Final report, September 1984-September 1987.** Payne, J.R.; Kirstein, B.E.; Clayton, J.R.; Clary, C.; Redding, R. (Science Applications International Corp., San Diego, CA (USA)). 15 Sep 1987. 218p. (SAIC—87/ETG-2). NTIS, PC A10/MF A01.

See also report dated November 1985, PB—87-121703.

Dispersed oil-droplet/suspended-particulate material (SPM) interactions provide a potential mechanism for transport of spilled oil to benthic marine environments. Oil/SPM interaction rates were measured to develop a mathematical model for sedimentation of spilled crude oil and refined petroleum products. Data are presented for the interaction of fresh and weathered Prudhoe Bay crude oil with a representative suspended particulate material type.

10809 **(PB—88-118625/XAB) Beaufort Sea Sale 97, Alaska Outer Continental Shelf, final environmental impact statement. Volume 1.** Roberts, R. (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Jun 1987. 485p. (MMS/AK/EIS—87/001). NTIS, PC A21/MF A01.

See also Volume 2, PB—88-118633, and PB—87-165114.

This Environmental Impact Statement (EIS) analyzes a proposed oil and gas lease sale in the Beaufort Sea, alternatives to the proposal, major issues determined through the scoping process, and potential mitigating measures. The proposal consists of 3,516 blocks, located in the Beaufort Sea Planning Area in waters that are from about 5 to 260 kilometers offshore. The mean economically recoverable resources unleased in the area are estimated to be 650 million barrels of oil with a marginal probability of 0.69 for hydrocarbons.

10810 **(PB—88-118633/XAB) Beaufort Sea Sale 97, Alaska Outer Continental Shelf, final environmental impact statement. Volume 2.** Roberts, R. (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Jun 1987. 323p. (MMS/AK/EIS—87/002). NTIS, PC A14/MF A01.

See Volume 1, PB—88-118625; Portions of this document are not fully legible.

This Environmental Impact Statement (EIS) analyzes a proposed oil and gas lease sale in the Beaufort Sea, alternatives to the proposal, major issues determined through the scoping process, and potential mitigating measures. The proposal consists of 3,516 blocks, located in the Beaufort Sea Planning Area in waters that are from about 5 to 260 kilometers offshore. The mean economically recoverable resources unleased in the area are estimated to be 650 million barrels of oil with a marginal probability of 0.69 for hydrocarbons.

10811 **DOE report assesses environmental impact of waste oil industry.** *Journal of the Air Pollution Control Association;* **37**: No. 7, 780(Jul 1987).

Most current methods of used oil and unused waste oil utilization and disposal create risks of contaminating air, water, or soil with substances that pose hazards to human, animal, and plant life. Recent actions taken to regulate used oil may create severe con-

straints on those who generate, collect, and handle used oil, such that many of them may leave the market. This may lead to decreased availability of sound disposal options resulting in increased improper disposal of used oil. The U.S. EPA has tried several times to classify used oil as a hazardous waste. The rationale for proposing such a regulation was that its implementation would force more energy recovery through fuel reprocessing and lube oil re-refining. The release of 61-128 million gal/year of used oil into the environment would likely threaten ground and surface waters with oil contamination, thereby endangering drinking water supplies and aquatic life. Therefore, in its latest attempt to classify used oil as a hazardous waste, EPA concluded that such a listing would discourage recycling or reuse.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 10889, 10890, 10907, 11601, 11602

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 10797, 10799

10812 **(CONF-8710220—1) Analysis and application of the constant tensile load test for polyethylene gas pipe materials.** Raske, D.T. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002868/JAW.

From 10. plastic pipe symposium; New Orleans, LA, USA (27 Oct 1987).

This paper describes the development of analytical models for constant tensile load (CTL) test data obtained on commercial polyethylene (PE) gas pipe materials. The objective of this study was to assess and describe the mechanical behavior of PE gas pipe materials in support of a program to improve the long-term reliability and performance of these materials in fuel gas distribution systems. In order to provide a basis for identifying and quantifying the critical parameters in the manufacture of high-quality PE pipe, the analytical models must also be capable of accommodating and correlating chemical and molecular properties. This paper discusses the various models studied, provides comparisons with CTL test experiments, and considers the suitability of the CTL test as a quality assurance (QA) tool for use by gas utilities and PE gas pipe manufacturers in evaluating new pipe lots. 12 refs.

0230 Properties

10813 **(DOE/FE/60177—2440) NMR and GC/MS investigation of the saturate and distillate fractions from the Cerro Negro heavy petroleum crude.** Netzel, D.A.; Guffey, F.D. (Western Research Inst., Laramie, WY (USA)). Aug 1987. Contract FC21-83FE60177. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002645/JAW.

Six fractions of the Cerro Negro heavy petroleum crude have been evaluated using nuclear magnetic resonance spectroscopy (NMR) and gas chromatography/mass spectrometry (GC/MS). The fractions include four saturated hydrocarbon distillate fractions distilling above 200°C (200 to 425°C [392 to 797°F], 425 to 550°C [797 to 1022°F], 550 to 700°C [1022 to 1292°F], and >700°C [>1292°F]) and two distillate subfractions designated as <200°C and >200°C. The >700°C and 550 to 700°C saturated hydrocarbon fractions are not suited for analyses by combined GC/MS because their distillation ranges are higher than the upper limit of material that will elute from the gas chromatographic column. The ^{1}H and ^{13}C NMR spectral data for the 550 to 700°C and >700°C fractions indicate that normal and branched alkanes with an average carbon chainlength of C_{10} are present but must be bonded to a larger molecular moiety based upon mass spectral evidence and boiling point considerations. Normal and branched alkanes were not detected in either 200 to 425°C or 425 to 550°C samples at concentrations of 0.01% by weight. NMR data for the 200 to 425°C fraction give no indication of normal alkanes with C chainlengths >9. Branched alkanes possibly of the isoprenoid-like structure are present. The average molecular structural representation is an alkyl-substituted dicyclic alkane. Average molecular structural representation for the 425 to 550°C fraction is also an alkyl-substituted dicyclic alkane. However, at least one of the alkyl substituents has a chainlength >10. Both normal and branched alkanes of C/sub 7-12/ were detected in the <200°C subfraction. Alkanes of C/sub 12-31/ were in the >200°C sample. ^{1}H and ^{13}C spectra for both subfractions indicate similar chemical composition. 12 refs., 6 figs., 8 tabs.

10814 **(EPRI-AP—5506) Stability and compatibility of residual fuel oils: Interim report.** Anderson, R.P.; Goetzinger, J.W.; Reynolds, J.W.; Brinkman, D.W. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Nov 1987. Contract FC22-83FE60149. 302p. NTIS, PC A14/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. Order Number DE88002589/JAW.

Refiners have found necessary to increase the conversion of resid to distillate fuels which has resulted in increased problems in product quality. Problems are particularly severe in residual materials which contain the highest levels of problem compounds such as asphaltenes or heteroatom compounds. A number of "problem" and "nonproblem" fuels supplied by utilities were analyzed in an attempt to understand the reasons for the reported problems. These fuels were carefully characterized by the determination of chemical and physical properties. It was apparent, however, that a baseline or conference test was needed to categorize the fuels as "problem" and "nonproblem". Therefore, supplemental samples were obtained through the cooperation of participating utilities, and these and initial samples were subjected to baseline tests for determining stability and compatibility characteristics. These baseline tests were the basis for the evaluation of rapid tests which might be useful for the prediction of potential problems. The conclusions of this program of research are presented in a final section. Recommendations are presented for the next phase of this study which includes technology transfer through implementation of predictive test methods at selected utilities as well as further investigation of promising prediction techniques. 344 refs., 15 figs., 32 tabs.

10815 **(IFP—34-859) Controlled oxidation of petroleum heavy cuts. Characterization and effects on thermal behavior.** Debled, B. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). Nov 1986. 221p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751488/JAW.

The aim of this thesis is a detailed examination of the influence of a control oxidative pretreatment on subsequent thermal behavior of a heavy petroleum residue. After a review of light oxidation methods adaptable to petroleum products, oxidation of Boscan atmospheric residue is studied for desulfurization and demetallization. Three oxidizing agents are retained m-chloroperbenzoic acid, the mixture hydrogen peroxide, acetic acid and the mixture hydrogen peroxide, methanol. Then thermal behavior of preoxidated Boscan is studied by pyrolysis at atmospheric pressure and under pressure of hydrogen argon and steam of 0 to 60 bars and 0 to 600/ sup 0/C. Influence on coke formation is examined.

0240 Storage

REFER ALSO TO CITATION(S) 12578, 12579, 12580, 12581

10816 **(PB—88-115340/XAB) Microbiological studies in rock caverns with jet fuel, heavy fuel oil, and crude oil.** Norqvist, A.; Roffey, R.; Edlund, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Sep 1987. 15p. (FOA-B—40307-4.9). NTIS, PC E03/MF A01.

In Sweden a large number of rock caverns have been used for long-term storage of different petroleum products. The storage system is based on the principle that the products are stored on a waterbed. The caverns are situated below the groundwater table so the water pressure prevents the products from leaking out of the caverns. During the last years some microbial problems have been observed in caverns with jet fuel and heavy fuel oil. In caverns with jet fuel, hydrogen sulfide was produced which gave rise to corrosive fuel. When storing heavy fuel oil, microbially produced methane has been the problem. In order to understand the factors

responsible for the microbial activities, physico-chemical and microbiological analysis of the bedwater in the caverns and the groundwater surrounding the caverns have been performed. Similarities and differences in activities between caverns with different petroleum products are discussed.

0250 Combustion

REFER ALSO TO CITATION(S) 10814

10817 (PE—8607) Combustion, sulphur neutralisation and vanadium balance tests with syncrude coke and Fort McMurray limestone in a pilot-scale atmospheric recirculating fluidised-bed reactor. Final report. (Polymath Energy, Vancouver, British Columbia (Canada)). Jul 1986. 78p. (MICROLOG—87-00600). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A series of tests was conducted to evaluate the combustion of coke from the Syncrude tar sands plant in an atmospheric circulating fluidized-bed pilot-plant. Key parameters investigated were combustion efficiency, the effectiveness of limestone from Fort McMurray, Alberta as a sulphur sorbent, sulphur capture, and the fate and distribution of heavy metals contained in the coke. The test program utilised 50 tons of Syncrude fluid coke and 30 tons of Fort McMurray limestone in a series of 19 test runs. Combustion temperatures (nominal) in the tests were 850, 900 and 950/sup 0/C. Runs were carried out with and without limestone injection to establish baseline SO/sub 2/ emissions and to obtain 90% sulphur capture. In 6 of the tests ash collected was reinjected into the combustor to ascertain the effect this had on sulphur capture and limestone utilisation. Since Syncrude coke contains about 6.5% sulphur, 0.20% vanadium and 0.06% nickel, effective capture of sulphur and heavy metals is critical if a commercial boiler is to be considered for the combustion of coke for steam and/or power generation. The tests showed that the Fort McMurray limestone is fairly reactive, and 90% sulphur capture was achieved. NO/sub x/ emissions could be minimised utilising a slightly lower combustion temperature (860-885/sup 0/C) and careful control of the ratio of primary air to secondary air. Vanadium and nickel in the coke concentrated in the fly ash with a significant amount also collecting in the boiler bottom ash. Conclusions drawn from the test program are that Syncrude fluid coke can be burned successfully in a circulating fluidized-bed boiler with high combustion efficiency, 90% sulphur capture, low NO/sub x/ emissions and low vanadium and nickel escape to the atmosphere. A commercial boiler can be designed to operate reliably on this fuel and should give no unusual operating problems. 13 figs., 15 tabs.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 11652

10818 (PB—88-108006/XAB) Gas Research Institute 1988-1992 research and development plan and 1988 research and development program. Executive Summary. (Gas Research Inst., Chicago, IL (USA)). Jun 1987. 24p. (GRI—87/0248.2). NTIS, PC A03/MF A01.

See also PB—88-113030, and GRI-780039.

This two-volume document presents GRI's 1988-1992 Research and Development (R&D) Plan and the 1988 R&D Program submitted to the Federal Regulatory Commission (FERC) for approval. Volume I presents background information, planning framework, and the proposed 1988-1992 R&D plan detailing rationale, objectives, goals, accomplishments, strategies, and milestones for each of GRI's overall objectives (Supply Options, End Use, and Gas Operations), and for GRI's Crosscutting Research. Volume II is an executive summary of the plan.

10819 (PB—88-108022/XAB) Historical review of Gas Research Institute research and development. Supplement. (Gas Research Inst., Chicago, IL (USA)). Jun 1987. 96p. (GRI—87/0247.3). NTIS, PC A05/MF A01.

See also PB—88-112867 and PB—88-112875.

This internal assessment evaluates GRI's performance during its first nine years of operation against GRI's mission and related goals. Volume I provides the detailed assessment showing: (1) 364 applied R&D concepts funded from 1978 to 1986; (2) a commercial success ratio of 30%, with 44 of 145 completed R&D efforts leading to commercial products; (3) consumer savings benefits of $3.5-7.0 billion on 34 of the 44 products; and (4) a benefit/cost ratio of 4:1 and a rate of return over 25% on total expenditures of $726 million through 1986. Volume II is an executive summary, and Volume III provides information on projects funded.

10820 (PB—88-112867/XAB) Historical review of Gas Research Institute research and development. (Gas Research Inst., Chicago, IL (USA)). May 1987. 63p. (GRI—87/0247.1). NTIS, PC A04/MF A01.

See also PB—88-112875 and PB—88-108022.

The internal assessment evaluates GRI's performance during its first nine years of operation against GRI's mission and related goals. The analysis measures successes in terms of quantifiable benefits and the scientific advances arising from ongoing work that will ensure continuous flow of such benefits. Also analyzed is GRI's management performance in terms of responsiveness to external inputs and results versus plans. GRI's principles for success are also examined. Volume I provides the detailed assessment showing: (1) 364 applied R&D concepts funded from 1978 to 1986; (2) a commercial success ratio of 30%, with 44 of 145 completed applied R&D efforts leading to commercial products; (3) consumer savings benefits of $3.5-7.0 billion on 34 of the 44 products; and (4) a benefit/cost ratio of 4:1 and a rate of return over 25% on total expenditures of $726 million through 1986. Volume II is an executive summary and Volume III provides information on projects funded.

10821 (PB—88-112875/XAB) Historical review of Gas Research Institute research and development. Executive Summary. (Gas Research Inst., Chicago, IL (USA)). May 1987. 15p. (GRI—87/0247.2). NTIS, PC A03/MF A01.

See also PB—88-112867 and PB—88-108022.

The internal assessment evaluates GRI's performance during its first nine years of operation against GRI's mission and related goals. Volume I provides the detailed assessment showing: (1) 364 applied R&D concepts funded from 1978 to 1986; (2) a commercial success ratio of 30%, with 44 of 145 completed applied R&D efforts leading to commercial products; (3) a consumer savings benefits of $3.5-7.0 billion on 34 of the 44 products; and, (4) a benefit/cost ratio of 4:1 and a rate of return over 25% on total expenditures of $726 million through 1986. Volume II is an executive summary and Volume III provides information on projects funded.

10822 (PB—88-113030/XAB) Gas Research Institute 1988-1992 research and development plan and 1988 research and development program. (Gas Research Inst., Chicago, IL (USA)). Jun 1987. 419p. (GRI—87/0248.1). NTIS, PC A18/MF A01.

See also GRI-780039 and PB—88-108006.

The two-volume document presents GRI's 1988-1992 Research and Development (R&D) Plan and the 1988 R&D Program submitted to the Federal Regulatory Commission (FERC) for approval. Volume I presents background information, planning framework, and the proposed 1988-1992 R&D plan detailing rationale, objectives, goals, accomplishments, strategies, and milestones for each of GRI's overall objectives (Supply Options, End Use, and Gas Operations), and for GRI's Crosscutting Research. Volume II is an executive summary of the plan. The 1988 program proposes an obligations budget of $174.9 million of which $146.7 million is for contract R&D obligations (26.8% to supply research, 56.0% to end use research, 12.8% to gas operations research, and 4.4% to crosscutting research). A funding unit of 1.59 cents per thousand cubic feet is also proposed. In 1988, GRI expects to supplement its R&D Program with $36.5 million and $48.4 million in coordinated funding, respectively, from government agencies and the industry.

10823 (PB—88-113048/XAB) Chemical Process Research Department substitute-natural-gas supply R and D status report. (Gas Research Inst., Chicago, IL (USA)). Dec 1986. 89p. (GRI—87/0135). NTIS, PC A05/MF A01.

The status report presents tactical objectives, goals, accomplishments, strategies, and contract status of ongoing SNG supply-related projects in GRI's Chemical Process Research Program as described in the 1987 GRI Plan. In the Coal Gasification Process area, projects include determination of the physical and chemical properties of finely ground de-ashed coal; a coal test program in a pressurized, fluidized-bed, ash-agglomerating process development unit; development of a CNG acid-gas-removal process; engineering evaluation of advanced coal-gasification processes; gathering of catalyst fabrication and performance data for the Direct Methanation process; and development of a design data base for coal gasification materials of construction. In-situ coal-gasification projects include economic evaluation of underground coal gasification (UCG) technology and UCG field testing at Hanna, Wyoming. The Methane From Waste project area supports research on anaerobic digestion of community wastes to pipeline-quality methane and field testing of the Refcom technology. In the Coal Sciences project area, funded projects deal with C-C cleavage, structure/reactivity relationships, modeling studies of coal reactivity characteristics and related aspects of catalytic and radical-cation chemistries, and advanced analytical techniques for characterization of coal materals.

10824 **(PB—88-123120/XAB) Gas Research Institute results of appraisal of GRI 1988-1992 R and D.** (Gas Research Inst., Chicago, IL (USA)). Jun 1987. 255p. (GRI—87/0132). NTIS, PC A12/MF A01.

See also GRI-78/0039.

To assure the quality of its R&D program, GRI annually reviews its past activities and prepares a comprehensive five-year plan wherein R&D activities are selected using a systematic process for evaluating the cost/benefit impacts of R and D alternatives. PAM, Project Appraisal Methodology, is an interactive computer-based management tool that forms the framework for the systematic process. The report describes the 1988 PAM process and explains the functional roles of the GRI staff and management in carrying out the planning process. Also presented are the PAM results used in developing the GRI 1988 R&D program and 1988-1992 Five-Year R&D Plan.

10825 **(PB—88-129937/XAB) Gas Research Institute: overview, January 1987.** (Gas Research Inst., Chicago, IL (USA)). Jan 1987. 10p. (GRI—87/0291). NTIS, PC A02/MF A01.

See also PB—88-129945.

The overview of GRI operations presents information on membership, funding, and focus of the GRI program, and distribution of the GRI R&D budget among four program areas. A brief description is also provided of projects that will benefit the industrial and commercial sectors, reduce emissions from burning coal, promote gas as an alternative fuel in stationary and mobile engines, and ensure adequate supply of natural gas from both conventional and unconventional sources. Also described are GRI's efforts to help define the government's role in long-term gas-related R&D.

10826 **(PB—88-129945/XAB) Gas Research Institute: an update, June 1987.** (Gas Research Inst., Chicago, IL (USA)). Jun 1987. 13p. (GRI—87/0292). NTIS, PC A03/MF A01.

See also PB—88-129937.

The update on GRI operations presents information on the planning process, the formal review mechanism for GRI R&D plans and budgets involving both state and federal commissions, and funding of the GRI program. A brief description is also provided of several projects (advanced oxygen/gad burner, improved gas making equipment, twinbed burner for heating metals, improved self-cleaning oven, efficient residential gas space heater, gas heat pumps, commercial water heaters, dessicant cooling system, absorption chiller system), and research efforts in the areas of clean-coal technologies, compressed natural gas technology, waste incineration, and enhanced gas recovery technologies.

10827 **(PB—88-129960/XAB) Gas Research Institute end-use R and D: industrial strategy and overview.** (Gas Research Inst., Chicago, IL (USA)). May 1987. 18p. (GRI—87/0313). NTIS, PC A03/MF A01.

Color illustrations reproduced in black and white.

GRI's Industrial Utilization Research program is based on a least-cost energy-service strategy that strives to make gas the preferred fuel because of the impact of advanced technology on economics, efficiency, and performance. Three elements dominate this strategy: maintain natural gas as the least-cost energy service option in traditional markets, enhance the competitive position of gas, and expand the role of natural gas in emerging high-growth industrial markets. The industrial program is weighted toward specific application areas (metals production processes, heat treating, nonmetals production and thermal processes, engine-driven systems, gas use for emissions controls, and burner systems) so that process improvements and new industrial equipment can move quickly to industrial acceptance and commercialization.

10828 **(PB—88-132170/XAB) Assessing the benefits of the Gas Research Institute's research and development programs. Final report.** Kinderman, E.M.; Kohan, S.M.; Coene, G.T. (SRI International, Menlo Park, CA (USA)). Mar 1978. 111p. NTIS, PC A06/MF A01.

See also GRI-78-27.

This study evaluates the potential benefits to gas-industry ratepayers of GRI's proposed gas supply (R&D) activities, using SRI International's National Energy Model for the overall evaluation. A secondary objective is to develop consistent price and quantity forecasts for principal energy commodities. Ratepayer benefits are evaluated for several future energy-demand scenarios and level of gas price for each new technology development involving the supply, to purchasers at the end-use level, of supplemental natural gas (SNG) and low- or intermediate-Btu gas from fossil fuels. Supply programs evaluated include SNG from coal, oil shale, peat, and in-situ coal gasification. Results indicate significant ratepayer benefits from the elements of GRI's gas-supply program examined.

10829 **(PB—88-132758/XAB) Data collection and analysis for the GRI (Gas Research Institute) Autumn 1979 program appraisal. Final report for 1979.** Hershey, R.L.; Holcombe, S.B.; Doring, C.K.; Hirsch, A.C. (Science Management Corp., Washington, DC (USA)). 15 Apr 1980. 68p. NTIS, PC A04/MF A01.

See also PB—88-132857.

Science Management Corporation collected and analyzed data for the Autumn 1979 appraisal of GRI's 1981 R & D program. Thirty-five project areas were analyzed for GRI Programs in Supply, Environment and Safety, and Efficient Utilization. These data included estimates of gas supplied or saved by research in a project area; costs associated with new technology; impacts on safety, reliability and the environment; and legal, social and institutional effects.

10830 **(PB—88-132857/XAB) Data collection and analysis for the GRI (Gas Research Institute) Autumn 1980 program appraisal. Final report for 1980.** Hershey, R.L.; Doring, C.K.; Grasser, S.H.; Ferreira, J.P. (Science Management Corp., Washington, DC (USA)). 13 Mar 1981. 110p. NTIS, PC A06/MF A01.

See also PB—88-132758.

Science Management Corporation collected and analyzed data for the Autumn 1980 appraisal of GRI's 1982 R&D program. Thirty-five project areas were analyzed for GRI Programs in Supply, Environment and Safety, and Efficient Utilization. These data include estimates of gas supplied or saved by research in a project area; costs associated with the new technology; impacts on safety, reliability and the environment; and legal, social and institutional effects.

0301 Reserves

REFER ALSO TO CITATION(S) 10853, 10866

0302 Geology And Exploration

10831 (DOE/MC/21181—1950-Vol.9) Geological evolution and analysis of confirmed or suspected gas hydrate localities: Volume 9, Formation and stability of gas hydrates of the Middle America Trench. Finley, P.; Krason, J. (Geoexplorers International, Inc., Denver, CO (USA)). Dec 1986. Contract AC21-84MC21181. 261p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88001007/JAW.

This report presents a geological description of the Pacific margin of Mexico and Central America, including regional and local structural settings, geomorphology, geological history, stratigraphy, and physical properties. It provides the necessary regional and geological background for more in-depth research of the area. Detailed discussion of bottom simulating acoustic reflectors, sediment acoustic properties, and distribution of hydrates within the sediments are also included in this report. The formation and stabilization of gas hydrates in sediments are considered in terms of phase relations, nucleation, and crystallization constraints, gas solubility, pore fluid chemistry, inorganic diagenesis, and sediment organic content. Together with a depositional analysis of the area, this report is a better understanding of the thermal evolution of the locality. It should lead to an assessment of the potential for both biogenic and thermogenic hydrocarbon generation. 150 refs., 84 figs., 17 tabs.

10832 (DOE/MC/21181—1950-Vol.10) Geological evolution and analysis of confirmed or suspected gas hydrate localities: Volume 10, Basin analysis, formation and stability of gas hydrates of the Aleutian Trench and the Bering Sea. Krason, J.; Ciesnik, M. (Geoexplorers International, Inc., Denver, CO (USA)). Jan 1987. Contract AC21-84MC21181. 183p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88001008/JAW.

Four major areas with inferred gas hydrates are the subject of this study. Two of these areas, the Navarin and the Norton Basins, are located within the Bering Sea shelf, whereas the remaining areas of the Atka Basin in the central Aleutian Trench system and the eastern Aleutian Trench represent a huge region of the Aleutian Trench-Arc system. All four areas are geologically diverse and complex. Particularly the structural features of the accretionary wedge north of the Aleutian Trench still remain the subjects of scientific debates. Prior to this study, suggested presence of the gas hydrates in the four areas was based on seismic evidence, i.e., presence of bottom simulating reflectors (BSRs). Although the disclosure of the BSRs is often difficult, particularly under the structural conditions of the Navarin and Norton basins, it can be concluded that the identified BSRs are mostly represented by relatively weak and discontinuous reflectors. Under thermal and pressure conditions favorable for gas hydrate formation, the relative scarcity of the BSRs can be attributed to insufficient gas supply to the potential gas hydrate zone. Hydrocarbon gas in sediment may have biogenic, thermogenic or mixed origin. In the four studied areas, basin analysis revealed limited biogenic hydrocarbon generation. The migration of the thermogenically derived gases is probably diminished considerably due to the widespread diagenetic processes in diatomaceous strata. The latter processes resulted in the formation of the diagenetic horizons. The identified gas hydrate-related BSRs seem to be located in the areas of increased biogenic methanogenesis and faults acting as the pathways for thermogenic hydrocarbons.

10833 (PB—88-130273/XAB) Borehole flowmeter. Final technical report, February 1984-October 1987. DiBello, E.G.; Haack, K.R.; McWilliams, J.L.; Pax, G.E.; Waterbury, S.S. (BDM Corp., Albuquerque, NM (USA)). Oct 1987. 213p. (BDM/A—87-0254-TRR1). NTIS, PC A10/MF A01.

A Prototype Borehole Flowmeter has been developed for the purpose of characterizing gas-flow distributions within Devonian Shale gas wells. Current technology for locating and measuring the gas-producing zones in the Devonian Shale well environment is indirect and inadequate due to the low flow rates involved. The ultrasonic flowmeter uses the time-of-flight approach to measure gas flow. Features incorporated in the borehole system include: (1) ultrasonic flowmeter, (2) temperature and pressure sensors, (3) gamma-ray counter, and (4) X-Y volumetric caliper. Bench testing of sonic transmitter/receiver components has verified the feasibility of the design approach. A prototype system was fabricated for use in the .1 to 10 foot per second range of gas flow. The prototype was tested in five wells.

10834 Finite element models of hydrofracturing and gas fracturing in jointed media. Shaffer, R.J.; Nilson, R.H.; Heuze, F.E. (Lawrence Livermore National Lab.). pp 797-804 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract W-7405-ENG-48.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The authors expanded their quasi-static finite element coupled fracture and flow model FEFFLAP to allow for time-dependent tracking of the fluid-driven fractures, under a constant pressure or a constant flow rate at the borehole inlet. These conditions apply to gas-driven fractures and to hydraulically-induced fractures, respectively. Example calculations are given to validate these new developments.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 10779, 10781

10835 (ERCB/C—D/87/5) G.N.E. Resources Ltd. Reduced gas well spacing. Prevo Field. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 27 Feb 1987. 3p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

G.N.E. Resources Ltd. applied for an order prescribing drilling spacing units for the production of gas from the Viking Formation. Gulf Canada Corporation submitted an intervention claiming to be the lessee of the mineral rights in the north half of the section. The Energy Resources Conservation Board granted G.N.E.'s request to establish one quarter section drilling spacing units. Views of the applicant, the intervenor, and the Board are detailed.

10836 (ERCB/C—D/87/6) Sulpetro Limited. Increased throughput and ethane recovery. Wapiti gas processing plant. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 2 Apr 1987. 8p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

In 1982, Sulpetro Limited submitted and was approved a Part 1 application for approval to extract ethane-plus (C/sub 2/+) from the natural gas processed at Wapiti gas processing plant. In 1985, Sulpetro submitted a Part 2 application for approval to operate the new facilities that included several design and operating changes made since the Part 1 application. Approval was granted to operate the plant in accordance with its Part 1 application. In light of objections the Energy Resources Conservation Board required Sulpetro to file additional information. Application was considered at a public hearing. The discussion regarding Part 1 vs. Part 2 applications is included. The Board decided to remove conditions imposed in 1985 and amend Sulpetro's approval to allow maximum operation with no restriction on ethane recovery efficiency.

10837 (ERCB/C—D/87/8) Application by Shell Canada Limited for approval of the transportation and processing of high hydrogen sulphide sour gas reserves in the Caroline Field and area (Bearberry demonstration project). (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 14 Apr 1987. 11p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Shell Canada Ltd. drilled wells in the Caroline Field and area in 1969 showing an H/sub 2/S content of about 90%. Shell has indicated that data on reservoir phase behaviour suggests that only one-third of the sulfur in the reservoir could be recovered.

There is a need for a demonstration project to determine if improved recovery is possible. The Bearberry demonstration project would last five years and be designed to establish the technical and economic feasibility of commercial development of the resource. It would consist of modular components. This hearing discusses the views of the applicant, the Energy Resources Conservation Board, and intervenors with regard to the design of the plant, the construction of pipelines, safety issues, and environmental impacts. The Board decided to grant an approval subject to further approval by the Minister of the Environment and also subject to conditions outlined in the Decision. The conditions included both community concerns and details of plant design.

10838 (PB—88-131438/XAB) Western tight sands gas development: economic and regulatory aspects of blanket resource supply. Final report, March 1981-May 1983. Hanson, D.A.; South, D.W. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). May 1983. 139p. (ANL/EES-TM—223). NTIS, PC A07/MF A01.

The purpose of this study was to assess the recoverable quantities and extraction costs of western tight-sands gas from blanket formations. Blanket tight-sands gas is found in continuous rock strata of low permeability that often requires stimulation by massive hydraulic fracturing. Families of marginal cost or resource supply curves were derived to present the economic results and illustrate the sensitivity of the recoverable resource and extraction costs to parameter changes. It was estimated that approximately 130 TCF of economically recoverable blanket-sands gas remains to be discovered.

10839 Rotary slot dog. Cutburth, R.W.; Smauley, D.A. (to Dept. of Energy, Washington, DC). US Patent 4,703,921. 3 Nov 1987. Filed date 24 Sep 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An assembly is described comprising: (a) a stepped body (b) a workpiece having a mounting hole therein receiving the lower body section and also having a surrounding flat surface adjacent the shoulder, (c) a base; (d) fastening means extending through the slot fastening the stepped body to the base and thereby clamping the workpiece between the shoulder and the base; and (e) the lateral dimension of the upper body section exceeding the lateral dimension of the lower body section by an amount of at least equal to the gap such that the workpiece is adjustable a distance transverse to the workpiece mounting hole equal to the combined length of the gap and the slot.

0304 Products And By-products

REFER ALSO TO CITATION(S) 11163

10840 (PB—88-132592/XAB) Mobile LNG (liquified natural gas) gelator. Final report, July 1980-September 1981. Rudnicki, M.I.; Hoffman, L.C.; Newton, R.A. (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Dec 1981. 64p. NTIS, PC A04/MF A01.

Gelled liquified natural gas (GELNG) offers potential safety advantages over LNG in the case of an accidental spill. GELNG has shown reduced spread area, lower vaporization rate, and crack sealing capability relative to the ungelled material. The purpose of this contract was to develop a mobile, continuous gelator which would produce a minimum of one cubic meter per hour of GELNG; previously, GELNG had been produced in small quantities by batch processes. Major achievements under the contract were the design and construction of the mobile gelator, checkout of the system with liquid nitrogen, and testing of the system on LNG. GELNG was not produced in the test series.

0305 Health And Safety

REFER ALSO TO CITATION(S) 10872

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 10794, 10866, 10869, 10870, 10881, 10884, 10887, 11598, 11644

10841 (CGA—8606) Canadian gas statistical summary 1986. (Canadian Gas Association, Don Mills, Ontario). Jun 1986. 14p. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $20.00 CAN.

This publication was prepared by the Canadian Gas Association. It highlights the growth of the Canadian natural gas industry in 1985 and provides some historical statistics back to 1960. It outlines the composition and direction of natural gas sales, exports, customers, and revenues.

10842 (CGA—8708) Canadian residential heating survey 1987. (Canadian Gas Association, Don Mills, Ontario). Aug 1987. 32p. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $20.00 CAN.

This is the fifth annual edition of the Canadian Residential Heating Survey, prepared by the Canadian Gas Association to highlight the penetration and expansion of natural gas in the residential heating market.

10843 (CGA/ES—8612) Historical statistics of the Canadian gas industry (with S.I. conversions), 1965-1985. (Canadian Gas Association, Don Mills, Ontario. Economics/Statistics Dept.). Dec 1986. 105p. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $30.00 CAN.

This publication contains two decades of data on the Canadian natural gas industry in both Imperial and S.I. (Metric) units. Data included are sales, exports, imports, and production of natural gas, and length of natural gas pipeline network. Utility sales and customers are also tabulated. Statistics are presented for Canada as well as for each province.

10844 (CGA/ES—8711) Canadian gas facts, 1987. (Canadian Gas Association, Don Mills, Ontario. Economics/Statistics Dept.). Nov 1987. 51p. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $25.00 CAN.

This publication illustrates the progress and growth of the natural gas industry and serves as a comprehensive reference. It lists natural gas volumes in cubic meters and cubic feet. Data included are production, sales, storage, and exports and imports of natural gas, energy consumption by type of energy, and length of natural gas pipelines.

10845 (MPUB—109/87) Greater Winnipeg Gas Company application to amend Board Order No. 97/87 that approved rates flowing from Board Order No. 89/87. (Manitoba Public Utilities Board, Winnipeg (Canada)). 2 Jul 1987. vp. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

This Order approves changes to Board Order No. 97/87, intended to clarify how the rates flowing from Order No. 89/87 are to be applied. Specifically, these changes apply to Buy/Sell customers and to the application of new rates. The rates set out in Order No. 97/87 were calculated and adjusted to include a "catch-up" component for November 1, 1986 to May 31, 1987. Since rates that are applicable to Buy/Sell customers should not contain the "catch-up" component, the Company provided a new schedule of rates applicable to those customers. This schedule was approved. The next amendment was the exclusion of "all gas consumed" from the text of Order No. 97/87 that read "all billings based on meter readings for all gas consumed on and after June 1, 1987." This would require a proration of the rates. Since the Company is unable to do such a proration, the change was approved.

10846 **(MPUB—119/87) Public hearing to establish buy/sell criteria for direct sale of natural gas to consumers in Manitoba.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 21 Jul 1987. 46p. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

This Order supercedes Board Order No. 71/87 dated April 15, 1987. The Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. submitted a report for consideration by the Public Utilities Board. This report detailed the reasons for the proposed Buy/Sell criteria and requirements and explored the options necessary to achieve flexible Buy/Sell arrangements while protecting the integrity of the distribution systems and the interests of the core customers. This report also included a generic form of the proposed Buy/Sell Agreement. Public meetings were held May 20 and 21, 1987. This Order deals with the establishment of the Buy/ Sell criteria and related issues.

10847 **(MPUB—125/87) Greater Winnipeg Gas Company application for approval of rates flowing from Board Order No. 123/87.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 27 Aug 1987. 7p. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

This Order flows from Board Order No. 123/87 of August 10, 1987 where the Greater Winnipeg Gas Company was instructed to calculate and present to the Board for approval a schedule of rates to be charged to all classes of consumers to recover on an annual basis the revenue requirements resulting from the allowed rate base and rate of return in Order 123/87. That Order instructed the Company to prepare a schedule of rates that would replace the minimum monthly bill charge with a fixed monthly charge, decrease the late payment charge, reduce the Interruptible and Special Service Rate, restructure the Firm Service Rate, and allocate the additional revenue from the fixed monthly charge to all customers. The Board approved the Schedule of Interim Rates and Selling Rates for Buy/Sell customers as proposed by the Company.

10848 **(MPUB—126/87) Buy/sell agreement between Greater Winnipeg Gas Company and Her Majesty the Queen in right of the Province of Manitoba.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 31 Aug 1987. 15p. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

Pursuant to the Public Utilities Board Order No. 119/87, the Greater Winnipeg Gas Company submitted a proposed Buy/Sell Agreement for consideration by the Public Utilities Board of Manitoba. The Board approved the proposed Agreement and ordered the Greater Winnipeg Gas Company to file with the Board a duly executed copy of the Agreement. This Order provides further details of the Agreement.

10849 **(MPUB—127/87) Buy/sell agreement between ICG Utilities (Manitoba) Ltd and Mohawk Oil Company Ltd.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 31 Aug 1987. 13p. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

Pursuant to the Public Utilities Board Order No. 119/87, ICG Utilities (Manitoba) Ltd. has submitted a proposed Buy/Sell Agreement for consideration by the Public Utilities Board of Manitoba. This Agreement, identified as ICG Utilites (Manitoba) Ltd. and Mohawk Oil Company Ltd., was approved. ICG Utilities (Manitoba) Ltd. was ordered to file with the Board a duly executed copy of the Agreement.

10850 **(MPUB—154/87) Interim ex parte order approving sales rates to be charged by ICG Utilities (Manitoba) Ltd. effective November 1, 1987.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 1987. 12p. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

In December, 1986, ICG Utilities (Manitoba) Ltd. made application to the Public Utilities Board of Manitoba for approval to amend its rate schedules to reflect the pricing agreement between ICG and TransCanada PipeLines Ltd. in October 1986. The revised schedule of rates in accordance with orders 98/87 and 89/87 was in effect only until October 31, 1987. ICG requested interim approval of revised rates to be in effect November 1, 1987. These are a result of an Agreement with TransCanada resulting in a reduction in cost of gas purchased from TransCanada. The Board approved the application.

10851 **(NEB—MH/1/87E) National Energy Board reasons for decision: Manitoba Oil and Gas Corporation.** (National Energy Board, Ottawa, Ontario (Canada)). Sep 1987. 19p. National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C.

In May 1987, Manitoba Oil and Gas Corporation (MOGC), as agent for and on behalf of residential, commercial, and industrial classes of consumers of natural gas in Manitoba, applied to the National Energy Board for final orders or interim orders directing TransCanada Pipelines (TCPL) to receive, transport, and deliver natural gas offered by MOGC for consumption in Manitoba and fixing the just and reasonable tolls that TCPL may charge for such services. By Order No. MH-1-87, the Board set the application down for public hearing. The hearing was held in Winnipeg, Manitoba, in September 1987. Views of the intervenors and the applicant are detailed. The conclusion of the Board was that the concept of self-displacement is not within the intent of the Agreement. The Board did not consider it appropriate to order tariff changes that would accommodate self-displacement. Reasons for the Board's decision are outlined.

10852 **(NEB—RH/4/86E) National Energy Board addendum to reasons for decisions: Interprovincial Pipe Line Limited.** (National Energy Board, Ottawa, Ontario (Canada)). 25 Sep 1987. 13p. National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C.

In June 1987, the National Energy Board issued its Reasons for Decision on an application by Interprovincial Pipe Line Limited (IPL) for new tolls for 1987. Certain figures for the determination of the revenue requirement were not contained therein and were to be calculated by IPL in accordance with the Reasons and Order. IPL filed with the Board the necessary revenue requirement, supporting working papers, and toll calculations. The Board has reviewed figures submitted by IPL and has found them to be in accordance with Order TO-2-87 and its Reasons for Decision. Consequently, in the interest of completeness, the Board issued this addendum to its Decision. The Board did not accept as the approved rate of return on Older System rate base the figure of 10.39 percent calculated by IPL. The rate of return approved by the Board is 10.38 percent.

10853 **(NEB-SS—22-1/1987-8F) Motives for decision relative to the examination of the methods for calculating natural gas surplus.** (Office National de l'Energie, Ottawa, Ontario (Canada)). Jul 1987. 63p. (In French). National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C.

One of the key responsibilities of the National Energy Board is to ensure that natural gas proposed to be exported is surplus to reasonably foreseeable Canadian requirements. In 1985, the Board reviewed the procedures used to determine natural gas surplus. In 1986, it announced new procedures based on the ration of reserves to production (the R/P Ratio Procedure). The current energy policy framework is based on the premise that the marketplace should determine the supply, demand, and price for natural gas. The Board considers it appropriate that this premise also form the basis for its surplus determination procedures. However, there are a number of factors that could impede the market from adequately and fairly meeting Canadian energy requirements in the face of increased export demand. The Board decided to adopt a surplus determination procedure, referred to as the Market-Based Procedure, which does not unduly interfere with the market when it is working to serve Canadian needs adequately and fairly, but which will provide for intervention by the Board whenever it finds that additional exports might cause the market to have difficulty in meeting reasonably foreseeable Canadian requirements. The Board will act in two ways to ensure that natural gas to be licensed for export is

surplus: one will be in the context of public hearings to consider applications for licenses to export natural gas; the other will be by monitoring Canadian energy markets on an ongoing basis. These methods are discussed in detail. In the Board's view, the Market-Based Procedure is fully compatible with the market-oriented pricing regime.

10854 **(ONE—MH/1/87F) National Energy Board reasons for decisions: Manitoba Oil and Gas Corporation.** (Office National de l'Energie, Ottawa, Ontario (Canada)). Sep 1987. 21p. (In French). National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C.

In May 1987, Manitoba Oil and Gas Corporation (MOGC), as agent for and on behalf of residential, commercial, and industrial classes of consumers of natural gas in Manitoba, applied to the National Energy Board for final orders or interim orders directing TransCanada Pipelines (TCPL) to receive, transport, and deliver natural gas offered by MOGC for consumption in Manitoba and fixing the just and reasonable tolls that TCPL may charge for such services. By Order No. MH-1-87, the Board set the application down for public hearing. The hearing was held in Winnipeg, Manitoba, in September 1987. Views of the intervenors and the applicant are detailed. The conclusion of the Board was that the concept of self-displacement is not within the intent of the Agreement. The Board did not consider it appropriate to order tariff changes that would accommodate self-displacement. Reasons for the Board's decision are outlined.

10855 **(ONE—RH/4/86F) National Energy Board addendum to Reason for Decision: Interprovincial Pipe Line Limited.** (Office National de l'Energie, Ottawa, Ontario (Canada)). 25 Sep 1987. 13p. (In French). National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C.

In June 1987, the National Energy Board issued its Reasons for Decision on an application by Interprovincial Pipe Line Limited (IPL) for new tolls for 1987. Certain figures for the determination of the revenue requirement were not contained therein and were to be calculated by IPL in accordance with the Reasons and Order. IPL filed with the Board the necessary revenue requirement, supporting working papers, and toll calculations. The Board has reviewed the figures submitted by IPL and has found them to be in accordance with Order TO-2-87 and its Reasons for Decision. Consequently, in the interest of completeness, the Board issued this addendum to its Decision. The Board did not accept as the approved rate of return on Older System rate base the figure of 10.39 percent calculated by IPL. The rate of return approved by the Board is 10.38 percent.

10856 **(PB—88-114095/XAB) Analysis of relative industrial performance and it's implications for gas demand.** Feldman, S.J.; Rogers, G. (Data Resources, Inc., Lexington, MA (USA)). Jul 1984. 224p. NTIS, PC A10/MF A01.

The analysis of the U.S. manufacturing sector and the opportunities it presents to the natural gas industry uses a weighted index of 11 economic/financial/market indicators to evaluate the performance of over 300 industries. Output and investment growth appear to be key determinants of industrial energy demand. Industries with high growth and investment potential over the period 1983-1993 are plastic materials and resins, aluminum rolling and drawing, motor vehicle parts, and glass products. Organic chemicals and paper mills exhibit above average potential, while petroleum refining, sugar, and primary aluminum are deemed slow growing industries.

10857 **(PB—88-123047/XAB) Gas laboratory SMART HOUSE (trade name).** (Gas Research Inst., Chicago, IL (USA)). 1987. 13p. (GRI—87/0296). NTIS, PC A03/MF A01.

Color illustrations reproduced in black and white.

The SMART HOUSE is a revolutionary approach to the distribution, use, and control of all forms of energy in homes. The concept involves distribution of gas via a system of semirigid piping system and use of a single hybrid cable offering electric power, communications, entertainment, security, and safety functions to every room in a house. GRI is conducting a research and testing program on the gas laboratory SMART HOUSE at the NAHB National Research Home Park in Bowie, Maryland. Advance gas features and equipment to be developed and tested at this site include zoned gas furnace, a space heater, compact gas meter, outdoor gas lights, residential cogenerator, direct-vent gas water heater, semirigid interior service piping, SMARTGAS range, natural gas dryer, remote-controlled gas grill, gas fireplace, methane detector, and future space-conditioning options.

10858 **(PB—88-123054/XAB) Projects within the Center for Advanced Materials. Annual report, June 1, 1986-May 31, 1987.** Hellmann, J.R.; Kennedy, B.K. (Pennsylvania State Univ., University Park (USA). Center for Advanced Materials). Jun 1987. 282p. (CAM—8701). NTIS, PC A13/MF A01.

This report documents the activities within the Center for Advanced Materials (CAM) at The Pennsylvania State University for its first year of operation under contract from the Gas Research Institute (GRI). Efforts included: (1) an assessment of the potential for using natural gas in ceramic and powder metal sintering technology; (2) identification of important research and development issues in high-temperature tribology of advanced ceramic and alloy materials; and (3) the definition of issues and opportunities in the development and implementation of a materials-properties design data base. In addition, efforts were directed toward establishing mechanisms for disseminating information generated by CAM researchers to the natural gas industry through the development of a newsletter and descriptive brochures, and by hosting workshops, short courses, and conferences.

10859 **(PB—88-129994/XAB) Development of an electronic compact gas meter. Phase 1 topical report, July-December 1986.** Pearman, A.N.J.; Hunter, G.D. (Honeywell, Inc., Golden Valley, MN (USA). Corporate Systems Development Div.). Jan 1987. 138p. (G—87017). NTIS, PC A07/MF A01.

A 0.5-inch sharp-edged orifice meter coupled with various microstructure pressure -ensing elements was used to characterize the microstructure performance on natural gas flows. Using these data, three compact gas-meter models were designed, built, and tested on a Minnegasco 5-foot bell prover. Data taken from these models indicate that a 0.75-inch pipe with a microstructure probe inserted on a diameter will work as a residential-sized flowmeter.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 10797, 10807, 10809, 10810, 12538

10860 **(CONF-8710210—1) Comparison of impacts on macroinvertebrates and fish from gas pipeline installation by wet-ditching and plowing.** Vinikour, W.S.; Schubert, J.P.; Gartman, D.K. (Argonne National Lab., IL (USA); Columbia Gas System Service Corp., Wilmington, DE (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02. Order Number DE88002893/JAW.

From 4. symposium on environmental concerns in rights-of-way management; Indianapolis, IN, USA (25 Oct 1987).

Biotic effects from wet-ditching were investigated at the Little Miami River, Ohio. Invertebrate densities decreased at, and a short distance below, the crossing site; partial benthic recolonization occurred within three weeks of construction, while complete recolonization occurred within seven months. Fish recolonized the affected area within one month, but densities were reduced; within eight months after construction, the fish community was similar to that observed before construction. Biotic effects from the plow method were examined at Canada Creek, Michigan. No significant impacts on benthic macroinvertebrates were detected. During ramp excavation, increased macroinvertebrate drift densities were noted, as well as increased occurrence of terrestrial invertebrates in the drift; upon completion of ramp excavation, drift composition approximated that before construction. No effects on fish species were indicated. Overall, no biotic impacts were detected within three days after pipeline installation. 23 refs., 4 figs., 3 tabs.

10861 (PB—88-112487/XAB) Evaluation of 3-D hydrodynamic computer models for prediction of LNG (liquefied natural gas) vapor dispersion in the atmosphere. Final report, March 1983-April 1987. Havens, J.A.; Spicer, T.O.; Schreurs, P.J. (Arkansas Univ., Fayetteville (USA). Dept. of Chemical Engineering). Aug 1987. 276p. NTIS, PC A13/MF A01.

See also report dated Mar 1984, PB—85-118503.

The SIGMET-N, ZEPHYR, MARIAH-II, and FEM3 computer models were evaluated for prediction of atmospheric dispersion of LNG vapor clouds. The SIGMET-N model is considered unsuitable for prediction of LNG vapor-cloud dispersion due to the impracticality of controlling numerical diffusion by grid fine-zoning and the use of a turbulent mixing submodel which does not scale properly. The ZEPHYR model is also considered unsuitable, primarily because of the use of a Lagrangian particle method for solving the gas mass balance equation which is not applicable to such strongly density-stratified flows. The numerical diffusion properties and the turbulent mixing submodels of MARIAH-II and FEM3 were evaluated by comparison of their predictions with analytical solutions, laboratory-scale gas-dispersion experiments comprising neutrally buoyant to strongly density-stratified two- and three-dimensional flows, and selected field experiments from the Thorney Island Heavy Gas Trials and the DOE Burro LNG tests. A turbulent-mixing model based on simplified second-order closure theory was evaluated, but modifications would be necessary before it could be recommended for LNG vapor-cloud-dispersion prediction.

10862 (PB—88-112768/XAB) Evaluation of NOx reduction technology for natural gas industry prime movers. Special report. Urban, C. (Southwest Research Inst., San Antonio, TX (USA)). Sep 1987. 25p. NTIS, PC A03/MF A01.

The report reviews the state-of-the-art in NOx reduction equipment and controls for prime movers used by the U.S. natural gas industry to drive pipeline compressors. Widespread development and application of NOx control measures is restricted by the extreme diversity of reciprocating engine types, models, sizes, and ages. About 30% of the industry's engines were installed before the mid-1950s. The economic or technical feasibility of modifying these older engines is questionable. NOx control technologies discussed are catalytic reduction, engine modification, and pre-stratified charge for reciprocating engines and catalytic reduction, combustor modification, and water injection for gas turbines. The discussion includes a description of and field experience with the technology, cost, past problems and potential for improvement, and applicability to the gas industry.

10863 (PB—88-123062/XAB) Natural gas and the environment: new issues, new opportunities. (Gas Research Inst., Chicago, IL (USA)). 1987. 6p. (GRI—87/0293). NTIS, PC A02/MF A01.

Because gas is a clean-burning fuel, natural gas technologies now under development can play a major role in improving the quality of the environment. Alone or in combination with other fuels, natural gas can be used to reduce emissions in a wide range of industrial, power plant, and vehicular applications. Its chemical composition makes natural gas suitable as a nutrient that stimulates certain bacteria to break down environmental pollutants in ground water. GRI's efforts in these fields are briefly discussed, along with the environmental issues addressed by such research efforts.

10864 (PB—88-123070/XAB) Assessment of the contribution of gas to the global emissions of carbon dioxide. Final report, February-December 1983. Reister, D.B. (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1984. 78p. NTIS, PC A05/MF A01.

The objective of this project is to assess the contribution of future gas combustion to the global emissions of carbon dioxide. The resources of natural gas are too small to make a significant contribution to ultimate carbon emissions. The carbon emissions from the production and combustion of gas can be significant; in some of the cases analyzed for the project, 50% of the carbon emissions are associated with gas. Increased use of synthetic gas does not increase carbon emissions unless the gas displaces electricity produced from nuclear power or solar energy.

10865 (PB—88-132998/XAB) NOx abatement in natural-gas-combustion exhaust gases by solid-state electrochemical technology. Topical report, September 1986-May 1987. Neyman, M.; Siwajek, L.; Cook, W.J.; Gordon, A.Z. (Southwest Research Inst., San Antonio, TX (USA)). Nov 1987. 70p. NTIS, PC A04/MF A01.

Solid-state electrochemical technology, embodied in the IGR deNOx process is used to reduce nitrogen oxides (NOx) to nitrogen and oxygen, and thereby control NOx emissions from natural gas powered engines. The IGR deNOx process is based on solid-state, flow-through, high-surface area, oxygen-ion-conductive ceramic electrolytes. Ceramic reactor elements made of fully stabilized zirconia (FSZ) (yttria-stabilized) were coated with porous silver electrodes, and tested with NO gas mixtures including a mixture containing CO_2, H_2O and N_2 using both electrical and gas-chromatographic analysis.

0309 Artificial Stimulation

10866 (CONF-8711110—1) Economic factors affecting the rate of development of coalbed methane resources. Flaim, S.J.; Hemphill, R.C.; Cohn, J.E. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03. Order Number DE88002849/JAW.

From Coalbed methane symposium; Tuscaloosa, AL, USA (18 Nov 1987).

The analysis contains a comparison of recent price forecasts for natural gas and a discussion of the discrepancies among the commercial service (Data Resources and others) and the Department of Energy's published forecasts in the National Energy Policy Plan. The assumptions underlying projected growth in energy sectors are explained. The analysis also includes an examination of historical exploration and development costs for crude and conventional methane resources based on footage and discoveries data from 1947 to 1984. Costs per crude equivalent barrel (COE-BBL) are computed for conventional methane resources and compared with costs similarly computed for some representative coalbed methane wells. Demand projections show nearly level growth for domestic natural gas consumption, and a slow decline in natural gas discoveries per crude equivalent barrel. Coalbed methane appears to be substantially less costly than exploring for conventional resources. With reasonable access to existing pipelines, coalbed methane resources may be less costly than drilling development locations for conventional methane.

10867 (PB—88-118245/XAB) Brine chemistry and control of adverse chemical reactions with natural gas production. Annual report, January-December 1986. O'Day, P.; Salimi, M.H.; Greenberg, J.; Sethuraman, G.; Tomson, M.B. (Rice Engineering Design and Development Inst., Houston, TX (USA)). Jan 1987. 131p. NTIS, PC A07/MF A01.

See also report for 1985, PB—86-203312.

Monitoring brine chemistry to determine the extent of potential adverse reactions has been simplified by the development of a field-brine test kit and a series of nomographs. Results of the kit analyses serve as input to the nomographs, which provide a graphic means of determining the scaling tendency (Saturation Index value) of a brine. Brines that do not tend to form scale may be corrosive. Saturation Index values were correlated with various processes using data from geopressured wells in the Gulf Coast area. Control of scale in surface equipment with chemical inhibitors has been successful. Numerous laboratory simulations of inhibitor squeeze operations were completed using core material with calcite present and absent. The corresponding wells were squeezed with phosphorous-containing inhibitors, and the flowback of brine was monitored for phosphorous concentrations vs time. A new procedure to measure the concentration of phosphorous-containing inhibitors down to 0.05 mg/l was developed and applied to brines from the Gladys McCall No. 1 DOE Design well. Methods to optimize inhibitor squeezes and scale and corrosion control are presently being investigated. The goal of the work is to understand the mechanisms responsible for scale and corrosion and to develop appropriate control measures.

10868 **(PB—88-118252/XAB) Measurement of static coalbed reservoir conditions for hydraulic-fracture design. Volume 1. Final report, March 1983-December 1986.** Boyer, C.M.; Briscoe, F.H.; Camp, B.S.; Dobscha, F.X.; Malone, P.G. (USX Corp., Monroeville, PA. USS Technical Center). Dec 1986. 130p. (REPT—76-H-088/089). NTIS, PC A07/MF A01.

A single-zone coalbed methane well was completed into the Mary Lee and Blue Creek coal seams in the Warrior basin of Alabama to evaluate the geologic and reservoir parameters that affect the stimulation and production of coalbed methane. Following the successful drilling and coring of the well, reservoir testing resulted in a measured coal-seam permeability of 1 millidarcy and a skin factor of -4 to +1. In-situ state-of-stress tests in the Blue Creek coal seam indicated a vertical primary closure and a secondary horizontal closure. Coal- and rock-core tests resulted in reservoir and mechanical values consistent with well-test data and underground-fracture observation.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 10835, 10836, 10837, 10838, 10845, 10846, 10847, 10848, 10849, 10850, 10853, 10873, 10874

10869 **(MPUB—155/87) Interim ex parte order approving sales rates to be charged by Greater Winnipeg Gas Company effective November 1, 1987.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 1987. 5p. Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

In December 1986, the Greater Winnipeg Gas Company (GWG) made application to the Public Utilities Board of Manitoba for approval to amend its rate schedules to reflect the pricing agreement between GWG and TransCanada PipeLines Ltd. in October 1986. The revised schedule of rates in accordance with orders 89/87 and 98/87 was in effect until October 31, 1987. GWG requested interim approval of revised rates to be in effect November 1, 1987. These are a result of an Agreement with TransCanada resulting in a reduction in cost of gas purchased from TransCanada. The Board approved the application.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 10797, 10843, 10844, 10850, 10851, 10852, 10854, 10855, 10869

10870 **(CGA—86) Directory of utility, transmission, and production companies 1986.** (Canadian Gas Association, Don Mills, Ontario). 1986. 103p. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $20.00 CAN.

This directory lists Canadian gas utility, transmission, and production companies. Included are outlines of the companies' operations and identification of executive officers and senior personnel. Among other company statistics are statistics for the length of distribution or transmission pipelines.

10871 **(CGA—OCC/2/1974) Recommended practice OCC-2-1987 (supercedes OCC-2-1974). Control of internal corrosion of pipeline systems that transport sour gas.** (Canadian Gas Association, Don Mills, Ontario). Mar 1987. 12p. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN.

This document was prepared by the Canadian Gas Association and presents recommendations for essential requirements and minimum practices for the control of internal corrosion of pipeline systems that transport sour gas. It serves as a guide for establishing minimum requirements for corrosion control in sour gas transmission lines and in gathering and flowlines.

10872 **(EPRI-EL—5472-Vol.1) Power line fault current coupling to nearby natural gas pipelines: Volume 1, Analytic methods and graphical techniques: Final report.** Dawalibi, F.; Southey, R.D..; Malric, Y.; Tavcar, W. (Safe Engineering Services and Technologies Ltd., Montreal, Quebec (Canada)). Nov 1987. 191p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920095/JAW.

A generalized approach to the analysis of the effects of transmission line faults on natural gas transmission pipelines has been developed and is presented in this report. A state of the art user-friendly computational tool has been developed and verified for the analysis of interference between electrical power lines and nearby buried or above-ground pipelines. This computer program, ECCAPP, is distinguished by its ability to model and analyze accurately complex, realistic interactions between pipelines and power lines, using easily obtained input data. The final report consists of three volumes. An independent fourth volume was also developed to simplify the installation of the ECCAPP software. This report, volume 1, contains the theory upon which the ECCAPP computer program is based. A parametric analysis and graphical charts have been formulated using ECCAPP to permit estimates to be made in the field or during preliminary analyses for situations that are not too complex. A discussion of various useful mitigation methods is included. The discussion is based on previous research work and on the results of the parametric analysis. 62 refs., 63 figs., 1 tab.

10873 **(ERCB—D/87/13) Application by Federated Pipe Lines Ltd to construct a pipeline and related facilities Bonnie Glen to Acheson.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1 Oct 1987. 15p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Federated Pipe Lines Ltd. applied for a permit to construct a proposed pipeline to allow transportation of high vapor pressure products from the Texaco Canada Resources Bonnie Glen gas plant. This would then complete a pipeline link. Applications for reversal of flow in some existing pipelines would be needed. A public hearing was held July, 1987. Views of the participants are discussed in this report. Issues considered were the necessity of the pipline, the establishment of a utility corridor, route selection issues, and safety concerns. The Board approved the decision subject to conditions and modifications.

10874 **(ERCB/C—D/87/1) Application by Novacorp Pipelines Ltd. to construct a pipeline and related facilities.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 6 Mar 1987. 10p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Novacorp Pipelines Ltd. (Novacorp) submitted an application for a permit to construct approximately 162.3 km of 168.3 mm outside diameter pipeline and related facilities for the transmission of condensate and butane from a point near Waterton, Alberta to a point near Turner Valley. The issues of the application were the need for and timing of the pipeline, the design, safety, and construction of the pipeline, and its proposed route. The Energy Resources Conservation Board concluded that the pipeline was needed to transport condensate from Shell's Waterton gas plant to markets in north-central Alberta, that the pipeline was designed in accordance with proper standards, that the route of the portion of the pipeline located outside the Chain Lakes Provincial Park is appropriate, and that the remaining segment of the route required further study. The Board approved the application pending further approval by the Minister of the Environment regarding that portion of the pipeline proposed within the Chain Lakes Provincial Park.

10875 **(PB—88-117098/XAB) Development of methods for design and installation of long-lasting polyethylene gas systems. Annual report, January 1985-December 1985.** Cassady, M.; Derringer, G.; Eiber, R.; Hulbert, L.; Jentgen, R. (Battelle Columbus Div., OH (USA)). Dec 1986. 180p. NTIS, PC A09/MF A01.

In 1985, Battelle began a new 4-year research program directed toward four major research tasks - determination of field

loads, study of fusion-joint integrity, study of squeeze-off, and development of methodologies to analyze and predict performance of PE gas-pipe systems. In addition, work was carried out on extended studies of the Slow Crack Growth (SCG) and Constant Tensile Load (CTL) tests and a reexamination of the results of the experimental evaluation of rapid crack propagation. The field load task started with the development of encapsulated strain gages for underground service on PE pipes. Preliminary measurements of squeeze-off effects were made with the stress-rupture test. The SCG test was further evaluated at a wider range of loads and test times and the feasibility of using a nondestructive method of determining damage growth was demonstrated. The CTL test was strengthened by comparing it with other ESCR tests and by applying a bilinear statistical model to the test results. The RCP test results were reevaluated and put on a firmer basis with statistical analyses and a model of initial defect-size effect on probability of RCP initiation.

10876 **(PB—88-129978/XAB) Repair coatings and durable paints for gas-distribution piping systems. Final report, April 1982-September 1983.** Saha, N.C. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1984. 115p. (IGT—30554-02). NTIS, PC A06/MF A01.

This research program was aimed at identifying field problems and needs with regard to gas distribution repair coatings and paints used in gas-distribution applications. Based on a literature review, user survey, and input provided by selected paint and coating manufacturers, field needs and problems in repair coatings and paints were identified, and user preference for materials, processes, cost, safety, and environmental impacts was analyzed. In addition, an examination of available coating materials, processes, and their effectiveness was completed.

10877 **(PB—88-132147/XAB) Benefit analyses of proposed research programs: distribution operations and industrial energy conservation. Final report.** (Battelle Columbus Labs., OH (USA)). 10 Mar 1978. 76p. NTIS, PC A05/MF A01.

This study analyses the benefits of GRI-sponsored distribution research activities in construction and maintenance (low-noise pavement removal, soft excavator, and improved backfill); metering (improved meter design and remote meter reading); piping-system design (plastic pipe and developments for hydrogen and synthetic fuel); and operational safety (leak identification, sonic leak pinpointing, new odorants, underground pipe corrosion detection, emergency shutdown techniques, and third party damage). Also evaluated are seven research areas impacting industrial conservation: industrial heat pump, industrial energy conservation, ceramic fiber-insulated furnaces, low NO_x burners, flared gas conservation, refrigeration recovery from LNG, and on-site LNG vaporizer/power plant.

10878 **(PB—88-132584/XAB) Condition assessment of underground-gas-distribution piping systems. Distribution Research Center year-end summary report, December 1982-May 1983.** Huebler, J.E.; Ziolkowski, C.J.; Saha, N.C. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1985. 80p. (IGT—30554-04). NTIS, PC A05/MF A01.

This summary report describes the results of first year work from December 1982 to May 1983 of Task 4 of the Distribution Research Center (DRC) program. Task 4 aims to develop an acoustic-emission nondestructive evaluation technique for the in-situ monitoring and assessment of the physical condition and material properties of underground steel and cast-iron gas distribution piping systems. A major achievement during the reporting period is the development of an experimental approach for characterizing flaw types from low-event-rate acoustic-emission sources. Also completed were the procurement and setup of a data acquisition system for obtaining and analyzing acoustic emission parameters and waveforms of the individual acoustic emission events.

0330 Properties

REFER ALSO TO CITATION(S) 10831

0340 Combustion

REFER ALSO TO CITATION(S) 10864, 10865, 11693, 11738, 11768, 12133, 12186

10879 **(PB—88-1127[illegible]/XAB) Synthesis and properties of a novel catalyst for the combustion of methane. Annual report, October 1986-June 1987.** Hicks, R.F. (California Univ., Los Angeles (USA). Dept. of Chemical Engineering). Jul 1987. 35p. NTIS, PC A03/MF A01.

Catalytic combustion is an attractive technology for utilizing the energy content of natural gas. However, there are no active catalysts that can sustain operation in a combustion chamber for acceptable periods of time. New support materials are needed that can maintain the platinum catalyst in its active state during combustor operation. This research is investigating a novel method of stabilizing high dispersions of platinum on supported catalysts at temperatures from 1000 to 1500 C.

10880 **(PB—88-112784/XAB) Pulsating burners - controlling mechanisms and performance. Final report, December 1, 1983-December 31, 1986.** Zinn, B.T.; Daniel, B.R.; Jagoda, J.I. (Georgia Inst. of Tech., Atlanta (USA). School of Aerospace Engineering). Jan 1987. 35p. NTIS, PC A03/MF A01.

See also PB—86-203197.

The objective of this study is to gain an understanding of the physical and chemical processes then control the performance of gas-fired pulse combustors. Performance measurements were carried out for combustors of different geometries. The chemical composition of the exhaust gases was measured and combustion efficiencies were calculated. The flow field in the combustor was visualized using high-speed shadowgraphy. The location and timing of the heat-release oscillations and their phase with the pressure fluctuations were determined by measuring acoustic pressures and radiation from OH radicals. The driving and damping characteristics of the combustor were determined by measuring growth and decay rates of the pressure oscillations.

10881 **(PB—88-123096/XAB) How gas cools (or, apples can fall up).** (Gas Research Inst., Chicago, IL (USA)). 1987. 10p. (GRI—87/0294). NTIS, PC A02/MF A01.

This primer on gas cooling systems explains the basics of heat exchange within a refrigeration system, the principle of reverse-cycle refrigeration, and how a gas-engine-driven heat pump can provide cooling, additional winter heating capacity, and hot water year-round. Gas cooling equipment available or under development include natural gas chillers, engine-driven chillers, and absorption chillers. In cogeneration systems, heat recovered from an engine's exhaust and coolant may be used in an absorption chiller to provide air-conditioning. Gas desiccant cooling systems may be used in buildings and businesses that are sensitive to high humidity levels.

10882 **(PB—88-123104/XAB) Natural gas engine-driven chillers.** (Gas Research Inst., Chicago, IL (USA)). 1987. 7p. (GRI—87/0295). NTIS, PC A02/MF A01.

Color illustrations reproduced in black and white.

GRI's effort to develop commercial gas-engine-driven cooling products is built around the use of automotive spark-ignition engines modified for continuous use on natural gas. The concept involves substitution of a gas-fueled engine for an electric motor to drive a vapor-compression cooling cycle. GRI is sponsoring the development of 150-ton and 500-ton packaged gas-engine-driven chillers and packaged direct-expansion rooftop air-conditioning units in the 10- to 75-ton capacity range. Field testing of seven prototype 150-ton chillers will start in the summer of 1987 at several commercial sites. Plans are underway for the field testing of the gas-engine-driven centrifugal chiller in 1988 and the rooftop units in 1989.

10883 **(PB—88-123112/XAB) Catalytic combustion of methane. Annual report, May 15, 1986-May 15, 1987.** Pfefferle, L.D.; Smooke, M.D. (Yale Univ., New Haven, CT (USA)). May 1987. 49p. NTIS, PC A03/MF A01.

Color illustrations reproduced in black and white.

The first year of a three-year experiment and modeling effort to characterize surface species and catalytic pathways in the catalytically stabilized combustion of natural gas resulted in the measurement of hydroxyl and atomic oxygen radicals in a reacting boundary layer over catalytic and noncatalytic plates. Laser-induced flourescence was employed to obtain spatially resolved concentration profiles of OH and O atoms in the boundary layer. Stability data were also obtained for mixtures of methane and ethane in a catalytically stabilized burner. A fully adaptive nonlinear parabolic partial differential equation solver was developed and applied in the validation of the detailed transport/finite rate chemistry boundary layer model.

10884 **(PB—88-130265/XAB) Cogeneration and gas-cooling research status report, 1986-1987.** (Gas Research Inst., Chicago, IL (USA)). Sep 1987. 177p. (GRI—87/0314). NTIS, PC A09/MF A01.

GRI has several end use R&D subprograms that address the objective of efficient gas utilization. This 1986-1987 status report presents information on current and planned activities in specific segments of GRI's Residential/Commercial Energy Systems (RCES) subprogram. Project areas covered include Commercial Heating and Cooling Systems (integrated dessicant systems, dessicant cooling, engine cooling, heat-actuated cooling, and pulse combustion boiler); Fuel Cell Systems (phosphoric acid fuel cells and advanced fuel cell concepts such as the solid oxide fuel cell, planar geometry solid oxide, and monolithic solid oxide fuel cell); and Engine-Driven Cogeneration Systems. Information provided for each project area include rational for funding the research effort, goals and objectives, a general statement on research accomplishments, and strategy being employed. A series of contract summary reports provide the status of each R&D contract.

10885 **(PB—88-130828/XAB) Development of a gas-fired vacuum furnace: an ion-nitriding application, Phase 1. Annual report, August 1986 to July 1987.** Hemsath, K.H. (Indugas, Inc., Toledo, OH (USA)). Sep 1987. 48p. NTIS, PC A03/MF A01.

Gas-fired vacuum furnaces have not been available in the past. Current vacuum furnaces are electrically heated. These furnaces can heat to high temperatures, are relatively expensive, and do not perform well when heating to lower (1400°F or less) temperatures. In this project, a gas-fired vacuum furnace was designed, built, and tested. The furnace design is based on a novel, patented heating concept which uses gas fired burners. High-velocity gases heat the surface of a round shell by impingement from the outside. The shell can be alternately heated and cooled, and is designed to sustain vacuum pressures. A novel vacuum-door design maintains atmosphere integrity and allows utilization of a soft seal.

10886 **Development of a ceramic recuperator for industrial applications.** Coombs, M.; Richlen, S.; Liang, W. (AiResearch Manufacturing Co.). pp 567-573 of High temperature heat exchangers. Mori, Y.; Sheindlin, A.E.; Afgan, N. New York, NY; Hemisphere Publishing (1986). (CONF-8508225—).

From 17. International Center for Heat and Mass Transfer symposium on high temperature heat exchangers; Dubrovnik, Yugoslavia (1 Aug 1985).

Recuperation of high-temperature furnaces can provide a dramatic increase in process efficiency. The higher the flue exhaust gas temperature, the higher the percentage of fuel that can be saved. The recuperator effectiveness parameter is defined as the ratio of the actual energy delivered to the combustion air divided by the maximum energy that could be transferred to the combustion air in a heat exchanger of infinite size. Thus, the effectiveness parameter is related to the size, and hence the cost, of the recuperator. Generally, furnace recuperators are in the range of effectiveness between 0.50 and 0.80. Within this effectiveness range, fuel savings of 30 to 70 percent are indicated for the flue gas temperatures and air preheat temperatures shown. While other considerations may limit the degree of recuperation acceptable with a given furnace (e.g., process control, NO/sub x/ formation, etc.), high levels of recuperation can offer a dramatic improvement in process efficiency for high-temperature industrial furnaces. As a result, the Gas Research Institute (GRI) and the Department of Energy (DOE) have an extensive program directed to developing high-temperature-ceramic recuperators suitable for operating in furnace flue gas streams up to 2500°F. AiResearch is currently developing a ceramic recuperator for these applications. The development of this recuperator system is described in this paper.

0350 Storage

10887 **(PB—88-133418/XAB) Assessment of storage and peaking strategies. Final report, February 1980-July 1981.** Daniels, E.J.; Blazek, C.F.; Foh, S.E.; Novil, M. (Institute of Gas Technology, Chicago, IL (USA)). Dec 1981. 241p. NTIS, PC A11/MF A01.

The base-case data and procedures required to analyze the natural gas industry storage and peaking system were developed. Storage requirements and additions were calculated using the base-case data to test the analytic procedures, which included trend extrapolation using historic data only, statistical analysis requiring a natural-gas-demand forecast, and linear programming methods using supply-and-demand forecasts on a regional basis. Potential future storage requirements were estimated. Because of the potential for storage additions in the future, the cost of service for new typical facilities was determined for the major generic storage and peaking-facility types likely to be built.

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

REFER ALSO TO CITATION(S) 10902

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 10901, 12188

10888 **(CES/NRC—84/473/1) Application of conventional mining techniques to underground oil sands mining.** (COMINCO Engineering Services Ltd./Norwest Resource Consultants Ltd., Calgary, Alberta (Canada)). 20 Aug 1985. 234p. (MICROLOG—86-01220). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Canadian oil sands deposits contain vast reserves of bitumen of which only a very small percentage is believed recoverable by surface mining. In-situ methods hold out most promise for recovery of bitumen from the deeper reserves. In the Athabasca field reservoir permeability is extremely low and conventional in situ processes recover a very small percentage of bitumen. Conventional underground mining techniques may be applied to increase permeability and to improve or assist the recovery of bitumen by in-situ processes.

10889 **(ERCB/C—D/87/3) Diamond Shamrock Exploration of Canada, Ltd. Application for a well license. Pembina Field.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 4 Feb 1987. 14p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Diamond Shamrock Exploration of Canada, Ltd. applied for a well license to drill a well underlying Pigeon Lake to be known as Diasham Pembina to obtain oil from the Leduc Formation. Interventions were received from landowners, both permanent and seasonal residents of the recreational area, expressing concern over the environmental impacts of the well. A public hearing was held in January 1987 to address the need for, location of, production from, and impact of the proposed well. In addition, the need for an emer-

gency plan was discussed. The Energy Resources Conservation Board decided that a well could be drilled without significant impacts on the area or residents and will issue a license when a satisfactory emergency response plan is submitted. Views of the applicant, intervenors, and the Board are expressed.

10890 **(ERCB/C—D/87/4) Corexcal, Inc. Application for a well licence. West Drumheller Area.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 23 Feb 1987. 8p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Corexcal, Inc. applied for a license to drill a well to be known as Corexcal West Drumheller for obtaining oil from the Nisku Formation. Interventions were received from landowners adjacent to the proposed well and from the City of Drumheller. The landowners expressed concern over the environmental impacts of the well; the City expressed concern over the effects upon the Tyrell Museum, a tourist attraction. The Energy Resources Conservation Board concluded that the well could proceed with minimum impact but required that additional measures be taken to reduce odor, noise, visual impact, and traffic. The application was approved.

10891 **(SAND—84-0818) Instrumented cratering tests SB-1 and SB-2 at the Anvil Points Mine: Final report.** Parrish, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 327p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE88002824/JAW.

Sandia National Laboratories conducted two heavily instrumented single blastwell cratering tests in June, 1983, at the Anvil Points Mine. These tests, one stemmed and one unstemmed, were executed to provide quantitative data for correlation with simulations made with existing rock fracturing models, to provide input data for use in the development and verification of rock motion models, and to examine the effect of reduced explosive gas pressure on the extent and degree of fragmentation. The diagnostic measurements verified satisfactory and repeatable explosive and stemming performance. The detonation-induced stress wave amplitudes and initial velocity changes were essentially the same for the stemmed and unstemmed tests. Rock motion measurements derived from the embedded sensor data and the photometric data compared favorably. Crater depths and volumes were less than predicted; they were essentially equal for the stemmed and unstemmed configurations. The particle size distributions were almost identical. No significant difference was seen between the stemmed and unstemmed configurations. The results from these tests, conducted in moderate (20 gpt) grade shale, were compared to results from tests conducted by Los Alamos National Laboratory in lean (5 to 10 gpt) shale. Crater and rubble volumes from a test in the lean shale were about 180% of those of an identical test in the moderate grade shale. The lean shale was broken into much smaller fragments; approximately twice the percentage of fragments passing through the same size sieve. Thus, while no significant difference was noted between stemmed and unstemmed tests in the same shale grade, substantial differences were found in results from tests conducted in different shale grades. 59 refs., 51 figs., 11 tabs.

10892 **(TG—850627) Application of geophysical techniques in oil sands.** Nichols, L.; Sartorelli, A.; Horne, E.; Henderson, J.; Khan, F. (Terracon Geotechnique Ltd., Leduc, Alberta (Canada)). 27 Jun 1985. 132p. (MICROLOG—85-6087). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This review study has examined the state-of-the-art of geophysical methods applied to the problem of dragline security in oil sand mines. This problem of security stems from the operation of 69 meter draglines on 50 meter high oil sand benches. These benches are prone to highwall failure by a variety of mechanisms. Primarily only one failure mechanism, the block failure, is of significance with respect to dragline security. The block failure mode offers a significant threat to the mining operation because of the tendency to occur along both old and freshly excavated highwall surfaces and in close proximity to the draglines, rapidity of failure, frequency of occurence, size, and difficulty in prediction. Block failures are caused by a coincidental combination of geological factors, groundwater conditions, and excavation activity. Syncrude Canada has developed a simple framework for its remedial approach to evaluating and avoiding potential block failures. This includes identifying the high risk areas, continuously monitoring highwall performance more intensely in the areas of dragline operation, and corrective action where conditions warrant. This report concludes with a review of the basic exploration surface and borehole geophysical methods that are available and that have been applied to the geological and economic evaluation of oil sand leases in the Athabasca area to define other geological targets such as formation boundaries, etc.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 10788, 10903

10893 **(BCU/CE—8505) Rapid pyrolysis of New Brunswick oil shale. Final report.** Watkinson, A.P.; Khoe, G.-K.; Tam, T. (British Columbia Univ., Vancouver (Canada). Dept. of Chemical Engineering). May 1985. 33p. (MICROLOG—86-01851). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Pyrolysis of New Brunswick oil shale was studied in two spouted bed reactors. The majority of the experiments was done in an electrically heated unit that contained sand spouted by a hot mixture of 15% CO/sub 2/-85% N/sub 2/. Oil shale of 0.5-1.0 mm, 1-2 mm, and 2-4 mm size was fed into the reactor at about 1.5 kg/h. Oil was recovered from a slip stream of the reactor off gases. The oil yields and elemental oil composition were determined as a function of reactor temperature (450-550/sup 0/C), particle size, and feed rate. The optimum temperature for pyrolysis of the 1-2 mm shale was about 475/sup 0/C at which oil yields of 89% of the Fischer Assay were reached. Coarser particles gave better results reaching in excess of 90% of the Fischer Assay. Higher feed rates of 3 kg/h were found to decrease the oil yield. Tests in the two stage pyrolysis unit in reducing gases generated by sub-stoichiometric combustion of propane showed that there is considerable potential to operate at higher shale feed rates of 4 kg/h and still achieve 89% of the Fischer Assay yield. 7 figs., 12 tabs.

10894 **(CIM—87/164) AOSTRA's underground test facility (UTF): mine assisted recovery under difficult conditions.** O'Rourke, J.C.; Haston, J.A. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1987. vp. (CONF-8705228—). Canadian Institute of Mining and Metallurgy, 400 - 1130 Sherbrooke Street, W., Montreal, P.Q., Canada H3A 2M8; $5.00 CAN.

From 89. annual general meeting of CIM; Toronto, Canada (3 May 1987).

The Alberta Oil Sands Technology and Research Authority (AOSTRA) has constructed an Underground Test Facility (UTF) in the Athabasca oil sands deposit in northern Alberta, approximately 50 km northwest of Fort McMurray. The facility initially is to serve as an underground laboratory from which to field test new approaches to in-situ recovery of the bitumen in the Athabasca deposit. The UTF employs mine access to get at the effective exploitation of an oil reservoir. It does so, however, under conditions considerably more difficult than those faced by most other applications of the technology. Because of the unconsolidated nature of the McMurray formation, the development of drilling chambers directly in the reservoir would be prohibitively expensive. Further, mobilization of the extremely viscous bitumen requires intensive steam stimulation with the attendant concerns of large, complex well completions and potentially hazardous operations. Overall, the oil sands present mining, drilling, and operations challenges that push the technology to a new state of the art. This paper briefly outlines the scope of these technical challenges, and presents an update of the UTF project to March 1987. 17 figs.

10895 (DOE/MC/11076—2441) Evaluation of steam-to-oxygen ratios for forward combustion in Asphalt Ridge tar sand. Johnson, L.A. Jr.; Romanowski, L.J. Jr. (Western Research Inst., Laramie, WY (USA)). Aug 1987. Contract FC21-86MC11076. 30p. NTIS, PC A03/MF A01; 1 ; GPO Dep. Order Number DE88002735/JAW.

Three one-dimensional and one three-dimensional physical simulations of forward combustion with steam-oxygen injection were conducted using Asphalt Ridge tar sand. One-dimensional simulations had steam-oxygen ratios of 3.1:1, 4.3:1, and 6.0:1 at oxygen fluxes of 10.8 to 8.0 scfh/ft². The three-dimensional simulation had a steam-to-oxygen ratio of 3.0:1. Results from the one-dimensional simulations show a reduction in the fuel deposition and oxygen demand as the steam-to-oxygen ratio increases. In conjunction with reduction in fuel deposition is the increase in combustion front velocity and oil yield with increasing steam-to-oxygen ratio. These trends are assumed to be the result of improved displacement efficiency of the steam zone that precedes the pyrolysis and combustion zones in the forward combustion process and suppression of coking by the steam. The effect of combustion front channeling was demonstrated by the three-dimensional simulation. Channeling caused a decrease in process sweep efficiency and oil yield with increased fuel consumption. Product oils from all simulations were significantly improved in quality compared with the original bitumen. The product oils had significantly lower molecular weights, viscosities, and percentage of components boiling above 1000°F (538°C). 12 refs., 10 figs., 6 tabs.

10896 (GULF/C—78/80/45) Distillation of Athabasca bitumen. (Gulf Oil Canada Ltd., Sheridan Park, Ontario. Research and Development Dept.). 14 Mar 1980. 8p. (MICROLOG—86-01207). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Distillation of three drums of Athabasca bitumen was carried out. This report consists of tables presenting material balance data and ASTM distillation data. Total pitch includes material recovered on cleaning the still; recovered pitch includes only the product recovered. Ninety percent of the total residuum was recovered as product.

10897 (RPC—ASL/82/202) Evaluation of oil shale from Eastern Canada by retorting and by concentration of a kerogen-rich fraction. Final report. Brown, G.W.; Abbott, D. (New Brunswick Research and Productivity Council, Fredericton (Canada)). 16 Dec 1981. 74p. (MICROLOG—84-1862). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

An apparatus was developed for testing the retorting behaviour of oil shales under pressures up to 500 psi hydrogen and 700/sup 0/C. Equipment was also constructed and brought into service for the determination of oil yields by the Fischer assay method. Six samples of Albert shale of varying oil content (<10 to 40-50 gals/ton) were tested by the Fischer method and by hydrogen retorting to determine yields of liquid distillate under different conditions of retorting. The Fischer assays gave oil yields of 2.9 to 47.5 gals/ton which corresponded to carbon conversion of 50.5 to 87.8 per cent. The hydrogen retorting tests at 700/sup 0/C and 500/sup 0/C gave carbon conversion rates of 53 to 87 per cent which are comparable to that for the Fischer retorting. Retorting at 500/sup 0/C gave oil yields similar to the Fischer assay but at 700/sup 0/C oil yields were reduced, 4 to 30 gals/ton, although gas yields increased. In the retorting tests performed, the use of hydrogen at 500 psi did not increase yields. More work is needed to understand the retorting behaviour of New Brunswick and other Canadian oil shales. Retorting tests for resource assessment purposes are also needed. These should be coupled to determining the rate of carbon conversion and hence the effectiveness of the retorting technique. Petrographic, chemical and thermogravimetric analyses of the oil shales were undertaken to characterize the materials for retorting tests. The second part of the project involved producing a kerogen concentrate by standard beneficiation methods, spherical agglomeration, gravity methods and by flotation. Only gravity separation showed promise of being a viable industrial process. Fine grinding and gravity separation gave high concetrations up to 70 gals/ton but yields were low. 11 figs., 13 tabs.

10898 (SC—8505) The optimization of a Bench Scale Hydrogenation Unit. Final report. (Stearns Catalytic Ltd., Sernia, Ontario (Canada)). May 1985. 4p. (MICROLOG—85-6079). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The bench scale hydrogenation unit developed for CANMET has been optimized in its operation and performance. A bitumen and coal mixture was introduced to the unit to demonstrate its operation at steady conditions for a minimum of four hours within a ten hour run. Throughout the period of modifications, training and instruction of the staff was carried out regarding instrumentation and controls in the operation of the unit.

10899 (SNC/TD—4711) Preliminary investigation desulphurization of hydrocracked pitch using phosphorus and phosphine. Cooke, N.E.; Dhawan, J.C.; Khadim, M.A. (SNC Group, Montreal, Quebec (Canada). Technical Development Dept.). Jul 1982. 41p. (MICROLOG—84-3981). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Preliminary experiments were carried out to explore the possibility of removing organic sulphur from hydrocracked pitch by treating it with phosphorus and phosphine at atmospheric pressure. Sulphur removal between 10 to 18% was observed. The sulphur was removed in the form of volatile organosulphur compounds as thiophene or a thiophene homolog. The increase in the phosphorus content of the residue indicates that phosphorus attaches to the pitch molecules under the experimental conditions. 3 figs., 7 tabs.

10900 (UCID—16986-87-3) Oil shale: Quarterly report, July-September 1987. Lewis, A.E. (ed.). (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004374/JAW.

In any rapid pyrolysis solid-recycle retorting system the degree of solid mixing necessary to accomplish full conversion of kerogen to oil is an important consideration. Using the Livermore pilot retort the extent of solid mixing was varied and the effect was observed on solid temperatures and kerogen conversion within the gravity bed retort. The results of this investigation are described. Water formation during oil shale pyrolysis has an impact on both chemistry and energy balance in a retort. A mass spectrometry method was developed and applied to the study of water evolution from batch pyrolysis of oil shale. Results of this study are also described in this report. 6 figs., 1 tab.

10901 (WGM—UP/W/247) An evaluation of processing options for the oil shales of Ontario (UP-W-247). Final report. (Watts, Griffis and McQuat Ltd., Toronto, Ontario (Canada)). 21 Jun 1985. 248p. (MICROLOG—86-01850). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Four oil shale-bearing formations from Ontario are reviewed with regard to mining, processing, and economic views. The highlight was the discovery that a light petroleum oil, rich in middle distillates, could be obtained from Ontario oil shales. The mining review demonstrated that Ontario oil shales would most likely be exploited by open-cast rather than underground methods from both a technical and economic standpoint. Processes that retort the oil shales in the presence of hydrogen have the most potential in terms of quantity and quality of oil and other end-products. Preliminary capital and operating costs have been developed for two processes and the economic analysis shows that Ontario oil shales are a source of valuable hydrocarbons and require further investigation. 38 figs., 18 tabs.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 10893, 10900

10902 (DOE/LC/11061—2526) DOE oil shale reference sample bank: Quarterly report, July-September 1987. Owen, L.B. (Terra Tek, Inc., Salt Lake City, UT (USA)). Sep 1987. Contract AC21-85LC11061. 37p. (TR—88-14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000295/JAW.

The DOE Oil Shale Program was restructured in FY84 to implement a 5-year period of basic and applied research in the study of the phenomena involved in oil shale pyrolysis/retorting. The program calls for the study of two reference shales per year for a period of 5 years. Consequently, the program calls for the identification, acquisition, processing, characterization, storage, disbursement, and record keeping for ten reference shales in a period of 5 years. Two FY86 and one FY87 reference shales have been acquired, processed and stored under inert gas. The Eastern shale, designated E86, was obtained from the Clegg Creek Member of the New Albany Shale at a quarry near Louisville, Kentucky in the first quarter of FY86. The FY86 Western Shale was obtained from the Exxon Colony Mine, located near Parachute, Colorado, during the first quarter of FY86. The FY87 Western Shale was obtained from the Tipton Member of the Green River Formation near Rock Springs, Wyoming during the fourth quarter of FY87. Partial distributions of the FY86 shale have been made to DOE and non-DOE contractors. Complete descriptions of the FY87 Western reference shale locale, shale processing procedures and analytical characterization are provided in this report. 7 refs., 6 figs., 1 tab.

10903 (KRD—831231) Oleophilic separation of bitumen in water emulsion products from in-situ thermal recovery of bitumen and heavy oil. Final report. (Kruyer Research and Development Ltd., Edmonton, Alberta (Canada)). 31 Dec 1983. 6p. (MICROLOG—87-04528). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Kruyer Research & Development Ltd conducted a study to evaluate oleophilic separation of bitumen/water emulsions with the emulsions supplied by the Canadian Department of Energy, Mines and Resources. Apparatus modifications, debugging and preliminary test work were done and reported here.

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 10905

10904 (ORF/ECE—P/4321/G) Wet oxidation of produced water ancillary fuels for oilfield applications. Phase 1. Kinetics, conceptual designs, and economics. Robey, H.L. (Ontario Research Foundation, Mississauga (Canada). Environmental and Chemical Engineering Div.). Apr 1985. 318p. (MICROLOG—86-03134). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

An extensive experimental program was undertaken to examine the application of wet air oxidation process to oil sand recovery operations. Batch scale experiments were conducted on produced waters, delayed coke, fluid coke, Eureka process pitch, and asphaltenes. The oxidation reaction kinetics of the produced waters tested were analagous to those of many organic materials, in that the oxidation rate inflected from a fast regime at about 50-75% conversion to a slow regime. With the solid fuels, however, rapid reaction proceeded until greater than 90% of the initial organic material was oxidized. Solid fuels are, therefore, particularly attractive candidates for wet oxidation. Continous flow pilot scale tests were attempted using produced water and fluid coke. A modification to the wet oxidation reactor was conceptualized which allows for extremely high energy output per unit reactor volume. This results in versatility of application with lower capital and operating costs as compared to the unmodified systems. A computer aided technical and economic assessment validated a considerable number of options for the application of wet air oxidation in oil sand recovery operations. Recommendations for future development of the process are discussed. 45 figs., 37 tabs.

0410 Environmental Aspects

10905 (DOE/MC/11076—2443) Geochemical modeling research related to the surface disposal of processed oil shale solid waste. Reddy, K.J.; Drever, J.I. (Western Research Inst., Laramie, WY (USA)). Oct 1987. Contract FC21-86MC11076. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003370/JAW.

Several geochemical codes are available in the literature to model chemical processes such as oxidation-reduction, precipitation-dissolution, formation of solution complex, adsorption, and ion exchange. However, these models differ in the environments to which they apply. The objective of this research was to evaluate the applicability of existing geochemical codes to predict water quality from an oil shale solid waste environment. We selected EQ3/EQ6, GEOCHEM, MINTEQ, PHREEQE, SOLMNEQ, and WATEQFC geochemical models for further evaluation. We concluded that all these models lack thermodynamic data for minerals and solution complexes which are important for oil shale solid waste studies. Selection of any one of the models would require development of a more reliable thermodynamic database, and this report describes the initiation of that work. So far, critical evaluation of thermodynamic data has been completed for Sr, F, Mo, and Se. 64 refs., 15 tabs.

10906 (LA-UR—87-3884) A comparison of atmospheric transport considerations in eastern and western oil shale operations. Barr, S. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 9p. (CONF-871198—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003164/JAW.

From Eastern oil shale symposium; Lexington, KY, USA (18 Nov 1987).

Atmospheric transport represents one of the critically important pathways for the distribution of pollutants from any oil shale operation. Our experience in studying eastern and western shale resources and operation suggest many common features regarding the atmospheric domain, but also many significant differences. Any issue of atmospheric transport and dispersion can be broken down into major elements: source factors which include the spatial and temporal distribution of pollutant sources as well as their chemical and physical characteristics, boundary conditions which include the character of the underlying surface as a lower boundary and the large scale meteorological circulations as an "upper" boundary; and meteorological structure is the resulting wind, temperature, moisture, and turbulence environment in the volume of air occupied by emitted material in an atmosphere subjected to the boundary conditions described above. For purposes of planning an industry, we want to be able to reliably model the atmospheric structure on a variety of time and space scales and the subsequent distribution of pollutants. This paper discusses differences in modeling concepts and results in the separate environments of eastern and western oil shale resources. 10 refs., 5 figs.

0420 Regulations

REFER ALSO TO CITATION(S) 10889, 10890

10907 (ERCB/C—D/87/2) Tumit Petroleums Ltd. Application for a well licence. Acheson East Field. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 16 Jan 1987. 6p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Tumit Petroleums Ltd. applied for a license to re-enter an abandoned well to be known as Tumit Ache for production from the Blairmore and/or Wabamun Formations. An intervention opposing the application was filed by Cascara Properties Ltd. and Integrated Building Corp. Ltd., the registered owners of the land on which the well is located, who are proposing an urban development. A public hearing was held in December 1986, where issues

regarding the need and location of a well were addressed; these issues are contained in this document. The Energy Resources Conservation Board was not satisfied that this applied-for location was the best for the proposed well. The application was denied.

05 NUCLEAR FUELS

0501 Reserves, Exploration, And Mining

10908 **(INIS-mf—11058-No.1) Uranium Newsletter. No. 1. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Fuel Cycle). Mar 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700807/JAW.**

Hard copies are available from IAEA Division of Nuclear Fuel Cycle.

The new Uranium Newsletter is presented as an IAEA annual newsletter. The organization of the IAEA and its involvement with uranium since its founding in 1957 is described. The "Red Book" (Uranium Resources, Production and Demand) is mentioned. The Technical Assistance Programme of the IAEA in this field is also briefly mentioned. The contents also include information on the following meetings: The Technical Committee Meeting on Uranium Deposits in Magmatic and Metamorphic Rocks, Advisory Group Meeting on the Use of Airborne Radiometric Data, and the Technical Committee Meeting on Metallogeneais. Recent publications are listed. Current research contracts in uranium exploration are mentioned. IAEA publications on uranium (in press) are listed also. Country reports from the following countries are included: Australia, Brazil, Canada, China (People's Republic of), Denmark, Finland, Germany (Federal Republic of), Malaysia, Philippines, Portugal, South Africa (Republic of), Spain, Syrian Arab Republic, United Kingdom, United States of America, Zambia, and Greece. There is also a report from the Commission of European Communities.

10909 **(NUREG/CR—5060) An approach to the mathematical modelling of the uranium series redistribution within ore bodies.** Airey, P.L.; Golian, C.; Lever, D.A. (Australian Atomic Energy Commission, Lucas Heights. Lucas Heights Research Labs.). Dec 1987. 113p. (AAEC/C—49). NTIS, PC A06/MF A01 - GPO. Order Number TI88900260/JAW.

The distributions of the uranium series isotopes in the Koongarra ore body were predicted by a simple one-dimensional model of isotopic migration parameters. Controlling the predictions were the retardation factors and the groundwater flow rates. The conditions modelled were a groundwater flow rate of 1 meter per year, retardation factors of 1×10^4 for ^{238}U and of 1.2×10^4 for ^{234}U, and ^{230}Th is immobile. For this set of conditions, an exceptionally good agreement was observed between field-measured isotope ratios and "predicted" isotope ratios. A multiphase model adequately describes the redistribution of uranium and daughter radionuclides in the weathered zone of the ore bodies. It redistributes U, Th and Ra isotopes among an aqueous phase, an amorphous iron phase, a crystalline phase and a phase of clay and quartz. 28 refs., 26 figs., 8 tabs.

0504 Feed Processing

REFER ALSO TO CITATION(S) 10986, 11076

10910 **(INIS-mf—11055) Determination of parameters dissolution of yellow-cake. Production of uranyl nitrate - Gas precipitation of AUC.** Mellah, A. (Haut Commissariat a la Recherche, Algiers (Algeria). Centre d'Etudes Nucleaires et Solaires). Jul 1987. 165p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number TI88701074/JAW.

The different stages of the purification cycle of yellow-cakes have been studied thoroughly in order to obtain an ammonium uranyl carbonate (AUC) as an intermediate product of uranium dioxide (UO/sub 2/). The optimal parameters of yellow-cake dissolution, filtration, extraction by solvent, scrubbing and stripping were determined. An original program of thermodynamic calculation was developed for the determination of the free energies of yellow-cake dissolution reactions. Different numerical methods were used to determine the kinetic constant, the reaction order and correlation equations of uranyl nitrate density as a function of U and H/sup +/ concentrations, before and after the extraction cycle. For the first time, Algerian filteraids were used for the filtration of uranyl nitrate solutions with satisfactory results. A laboratory designed installation enabled the precipitation of AUC by injection of ammonia and carbon dioxide gases. Interesting results have been obtained and further investigations should be carried out in order to optimize all the paremeters of the gas precipitation of AUC.

0505 Uranium Enrichment

10911 **(ECN—201) Measurement of the enrichment of uranium-hexafluoride gas in product pipes in the centrifuge enrichment plant at Almelo.** Packer, T.W.; Lees, E.W.; Aaldijk, J.K.; Harry, R.J.S. (Netherlands Energy Research Foundation, Petten). Sep 1987. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700788/JAW.

Also published by UKAEA Harwell, report No. SRDP-R—137 (Mar 1987).

One of the objectives of safeguarding centrifuge enrichment plants is to apply non-destructive measurements inside the cascade area to confirm that the enrichment level is in the low enriched uranium range. Research in the UK and USA has developed a NDA instrument which can confirm the presence of low enriched uranium on a rapid go/no go basis in cascade header pipework of their centrifuge enrichment plants. The instrument is based on a gamma spectroscopic measurement coupled with an X-ray fluorescence analysis. This report gives the results of measurements carried out at Almelo by the UKAEA Harwell, ECN Petten and KFA Juelich to determine if these techniques could be employed at Almelo and Gronau. The energy dispersive X-ray fluorescence analysis has been applied to determine the total mass of uranium in the gas phase, and the deposit correction technique and the two geometry technique have been applied at Almelo to correct the measured gamma intensities for those emitted by the deposit. After an executive summary the report discusses the principles of the two correction methods. A short description of the equipment precedes the presentation of the results of the measurements and the discussion. After the conclusions the report contains two appendices which contain the derivation of the formulae for the deposit correction technique and a discussion of the systematic errors of this technique. 8 figs.; 11 refs.; 6 tables.

10912 **UF/sub 6/ test loop for evaluation and implementation of international enrichment plant safeguards.** Cooley, J.N.; Fields, L.W.; Swindle, D.W. Jr. (International Technology Programs, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* 16: 771(Jul 1987). (CONF-870713—). Contract AC05-84OR21400.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A functional test loop capable of simulating UF/sub 6/ flows, pressures, and pipe deposits characteristic of gas centrifuge enrichment plant piping has been designed and fabricated by the Enrichment Safeguards Program of Martin Marietta Energy Systems, Inc., for use by the International Atomic Energy Agency (IAEA) at its Safeguards Analytical Laboratory in Seibersdorf, Austria. The purpose of the test loop is twofold: (1) to enable the IAEA to evaluate and to calibrate enrichment safeguards measurement instrumentation to be used in limited frequency-unannounced access (LFUA) inspection strategy measurements at gas centrifuge enrichment plants and (2) to train IAEA inspectors in the use of such instrumentation. The test loop incorporates actual sections of cascade header pipes from the centrifuge enrichment plants subject to IAEA inspections. The test loop is described, applications for its use by the IAEA are detailed, and results from an initial demonstration session using the test loop are summarized. By giving the IAEA the in-house capability to evaluate LFUA inspection strategy approaches, to develop inspection procedures, to calibrate instrumentation, and to train inspectors, the UF/sub 6/ cascade header pipe test loop will contribute to the IAEA's success in im-

plementing LFUA strategy inspections at gas centrifuge enrichment facilities subject to international safeguards inspections.

10913 **Improvements in collimator design for verification of uranium enrichment in gaseous centrifuge header pipes of diameter 4.45 cm and 10.16 cm.** Close, D.A.; Pratt, J.C. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research;* 257: No. 2, 406-411(15 Jun 1987).

A technique that has been developed determines whether the process gas in a gaseous uranium centrifuge header pipe has an enrichment ≦ 20% or > 20%. Improvements have been made in the detector collimator to improve the ability to discriminate between gas and deposit in the header pipes. The new detector collimator has been characterized for pipes having inner diameters of 4.45 and 10.16 cm. A statistical analysis indicates that this new design is well suited to the smaller diameter pipe.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 11508, 11509

10914 **(CONF-871101—72) Correlation between annealing and irradiation behavior of dispersion fuels: Final report.** Wiencek, T.C.; Domagala, R.F. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003039/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

Studying the effects of annealing of scaled-down dispersion fuel plates is an important part of the data base for fuel performance. One of the most critical aspects of fuel performance is the stability of a fuel/matrix dispersion which is usually measured by volumetric changes of the fuel zone. A correlation has been proposed that fission-induced amorphization is responsible for the instability of the fuel and that such transformations can be predicted by the thermodynamic properties of the fuel. It is proposed that annealing studies may be used as a screening test for new fuels for which no thermodynamic properties have been measured and/or no irradiation data are available. Estimations of irradiation performance could be obtained faster and without the expense of irradiating the fuels under investigation. Miniature fuel plates were fabricated by standard procedures and annealed at 400°C for up to 1981 hrs in a resistance wound furnace. At periodic intervals the plates were removed and the fuel zone volumes were calculated based on immersion density measurement data. 7 refs., 1 tab.

10915 **Attributes measurements by calorimetry in 15 to 30 minutes.** Fiarman, S.; Perry, R.B. (Brookhaven National Lab., Upton, NY 11973). *Journal of Nuclear Materials Management;* 16: 754-759(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

An analysis of the early portion of the power-history data collected with both of the IAEA's air-cooled bulk calorimeters has demonstrated that such calorimeters can measure the power from preheated containers of plutonium oxide with an accuracy of 2-5% in 15 to 30 minutes. Material accountancy at plutonium facilities has a need for such a capability for measurement of Pu scrap. Also, the IAEA could use just two calorimeters and a gamma-ray assay system for reliable variables and attributes measurements of plutonium mass during a two-day physical-inventory verification (PIV) at a mixed-oxide (MOX) fuel-fabrication facility. The assay results would be free of the concerns about sample moisture, impurities, and geometry that previously have limited the accuracy of assays based on neutron measurements.

10916 **How well does ORIGEN predict spent LWR fuel characteristics.** Mailen, J.C.; Roddy, J.W. (Chemical Technology Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 575-580 of Waste management '87: Waste isolation in the US, technical programs, and public education. Post, R.G. Tucson, AZ; University of Arizona Nuclear Engineering Dept. (1987). (CONF-870306—). Contract AC05-84OR21400.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The ORIGEN computer code is widely used to estimate the radionuclide content (actinides, activation and fission products) of irradiated reactor fuel and the resultant heat generation and radiation levels associated with such fuel. These estimates are used as source terms in safety evaluations of operating reactors, for evaluation of fuel behavior and regulation of the at-reactor storage, for transportation studies, and for evaluation of the ultimate geologic storage of the fuel. This survey summarizes the fuel data available in the open literature and, where given, the calculated values by ORIGEN. Plans for additional analyses of well-characterized reactor fuel samples to improve the validation of ORIGEN2 are discussed.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 10955, 10988, 12381

10917 **(BMU—1987-154) Comparison of two alternative processes for the disposal of tritiated water from LWR reprocessing under radiological and safety aspects. Vol. 1. Final report.** Gutowski, H.; Bracha, M. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Linde A.G., Muenchen (Germany, F.R.). Werksgruppe TVT). 1987. 188p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

The following two processes were examined: Direct electrolysis (DE) and cryogenic distillation and liquid-phase catalytic exchange (LPCE) and cryogenic distillation. In both cases the enriched product stream (H/sub 2//HT) from the cryogenic distillation will be fixed and stored on metal hydrides, whereas the waste stream which is sufficiently depleted in tritium, will be discharged to the biosphere. The comparison showed no clear preference for either of the two processes. By the state of the art, however, the direct electrolysis and cryogenic distillation should be favoured, since the catalytic exchange suffers from lack of experience concerning the catalyst and the availability of an appropriate catalyst. On the other hand the LPCE process is simpler by design and maintenance (electrolyser) and should be prefered when a proved catalyst will be available.

10918 **(BMU—1987-158) Criticality calculation of standard problems on the dissolution of spent fuel.** Weber, W.; Gmal, B.; Heinicke, W. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Apr 1987. 85p. (In German). (GRS-A—1337). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

In criticality safety analyses of a nuclear reprocessing plant one meets great demands upon the calculational methods used because of the complexity of the fissile systems, use of special materials and of the large dimensions required for process components. The Committee on the Safety of Nuclear Installations (CSNI) at the OECD commissioned an international expert group to perform a standard problem exercise on the calculation of dissolver systems in reprocessing plants. The working group, in which the Gesellschaft fuer Reaktorsicherheit (GRS) is participating, has selected and calculated critical experiments for uranium dioxide and uranium-plutonium mixed oxide (MOX) lattices in water and fissile solution with boron, gadolinium and hafnium as a neutron absorber.

The calculations of GRS, which generally were performed with the codesystem SCALE, agree very well with the experimental values for systems without neutron poisons and with boron as an absorber. The average deviation of the effective multiplication factor amounts to about +- 0.5%. The experiments with gadolinium or hafnium neutron absorber are underestimated by about 2% on the average.

10919 **(ENEA-RT-COMB—85-8) Volume determination of accountability vessels in reprocessing plants. Ritex experience.** Aparo, M.; Bardone, G.; Dionisi, M. (ENEA, Frascati, Italy. Centro Ricerche Energia). (ENEA, Casaccia (Italy). Centro Ricerche Energia). 1985. 36p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701266/JAW.

The measurement of the Nuclear Material content in the spent fuels dissolution product is of a great importance both for the Safeguards Authorities and the Plant Management. This measurement is carried out in special vessels, currently called Input Accountability Vessels. In the present report the procedures applied and the instrumentation used both during the calibration and in the operational stages are described; moreover, the method and the statistical techniques currently used for the calibration data treatment and evaluation are reported and discussed. A critical analysis of all the possible sources of error in the Volume determination is also included. The goal of the present work, taking into account the Ritex experience results, was to demonstrate the needs of selecting the methodologies, the procedures and the instrumentation able to guarantee, besides a better precision, highly reliable Volume measurements for Accountability and Safeguards controls in the input section of a Reprocessing Plant.

10920 **(KFK—4187) Krypton separation from waste gas of a reprocessing plant by low temperature rectification. Proceedings.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Jan 1987. 139p. (In German). (PWA—92/86; CONF-8511320—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW.

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

6 lectures at this seminar describe and evaluate the results of the research and development work on low temperature krypton separation from the waste gas of the reprocessing of nuclear fuels. They are used for making decisions for the process to be used in the future on a large scale at the Wackersdorf reprocessing plant. 2 further lectures deal with alternatives to this process, which were also developed: the freon washing and low temperature adsorption of krypton. All the lectures were included separately in the INIS and ENERGY databases.

10921 (KFK—4187, pp 7-42) **Selection and development of the KRETA process.** Ammon, R. von. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

The historical development and decisions on krypton separation in waste gas from a large reprocessing plant by low temperature rectification and experience with the half scale plants ADAMO, KRETA und REDUKTION are described. The reduction stage (catalytic reduction of O/sub 2/ and NO/sub x/) is regarded as absolutely essential for pre-cleaning. The rectification plant KRETA is operated together with ADAMO (for the adsorptive separation of impurities). There is a report on extensive series of experiments to determine material data and for the simulation of radiolysis reactions.

10922 (KFK—4187, pp 43-71) **Technical process developments for krypton separation by low temperature rectification process.** Hutter, E.; Neffe, G. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Hauptabteilung Ingenieurtechnik). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

Experience with and improvements to the adsorptive precleaning (ADAMO) and the cryogenic krypton separation (KRETA) are described. Details of system improvements, particularly the development of columns are explained by sketches.

10923 (KFK—4187, pp 73-87) **Operating experience with the REDUKTION and KRETA-ADAMO experimental plants.** Amend, J.; Oberacker, S.; Ammon, R. von; Bumiller, W. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Hauptabteilung Kerntechnische Betriebe; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

The tested REDUKTION and KRETA-ADAMO plants permit the operating processing of typical waste gas from a reprocessing plant. The components used can be used continuously and showed a high plant availability. There were no faults at any time which affected the proper operation of the plants. The danger of poisoning of the REDUKTION catalyst was considerably reduced by increased control. Improved control instrumentation seems appropriate for simultaneous separation of O/sub 3/ with the Xe product, which also guarantees higher purity of the krypton.

10924 (KFK—4187, pp 89-101) **Safety considerations for low temperature rectification of fission inert gases.** Penzhorn, R.D.; Weh, M.; Guenther, K.; Ache, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Radiochemie). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

In a consideration of the risks of low temperature rectification of krypton from waste gas, the main point is the radiolytic formation of ozone, whose boiling point is nearly equal to that of xenon, in which it can be enriched. The explosion limit values of ozone in oxygen or in different dilutants (He, Ar, Kr, Xe, N/sub 2/ and CCl/sub 2/F/sub 2/) and the speed and preasure of the stationary detonation of O/sub 3/ in inert gases depending on the mol fraction O/sub 3//O/sub 2/ were determined. The propagation of a detonation by a typical column filler, the effect of impurities (CH/sub 4/, CO, NO/sub 2/) on explosion and detonation and the phase equilibrium O/sub 3//Xe were also examined.

10925 (KFK—4187, pp 103-110) **Krypton recovery from reprocessing off-gases by cryogenic distillation.** Geens, L.P.; Goossens, W.R.A.; Marien, J. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Jan 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

With the financial support of the C.E.C., krypton recovery by cryogenic distillation in presence of oxygen was investigated. Both oxygen and ozone behavior in the cryodistillation unit were observed. The ozone decay in the rectification column was studied in absence and in presence of a radiation source. Additionally a demonstration run with krypton-85 was performed. Experiments with different oxygen concentrations up to 21% volume in the feed gas were carried out. The oxygen was enriched up to 85% volume

in a zone between the krypton layer and the entrance of the rectification column. No oxygen was found in the bottom product. On the other hand, the ozone accumulated in that bottom product. The decay of ozone in the bottom liquid was measured in absence and in presence of a 500 Ci thulium-170 source. Without the radiation source, it took almost 30 days to observe a decay from 0.90% volume to 0.45% volume. The decay rate decreased with decreasing ozone concentration. In presence of the 500 Ci thulium-170, a constant decay rate of 0.24% volume per day was measured. Finally, a demonstration run with 100 Ci krypton-85 was performed in the cryodistillation unit, with air as feed gas. The krypton-85 was fed at a concentration of 30 mCih/sup -1/ until the total krypton inventory of the rectification column amounted to 40-45 Ci. The active run had a duration of 900 hours, during which no operational problems occurred.

10926 (KFK—4187, pp 111-114) **Development of low temperature rectification for Kr-85 separation in a reprocessing plant.** Amend, J.; Ammon, R. von; Hutter, E.; Kroebel, R.; Leichsenring, C.H. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Hauptabteilung Kerntechnische Betriebe; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Projekt Wiederaufarbeitung und Abfallbehandlung). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

The history of the development of low temperature rectification for removing krypton 85 from the waste gas is briefly described. Experience gained by the Karlsruhe Nuclear Research Centre in this period compared to processes developed elsewhere (low temperature washing with fluorine/chlorine hydrocarbon R12, low temperature adsorption in fixed beds) are used to make decisions for the large Wackersdorf reprocessing plant. The KfK reference process contains the preseparation or combustion of O/sub 2/ and NO/sub x/ by reduction with hydrogen on a precious metal catalyst, the adsorptive removal of H/sub 2/O and CO/sub 2/, and the subsequent low temperature rectification for separating N/sub 2/,Xe and Kr. A proposal is made based on experience and the desirable boundary conditions for the Wackersdorf reprocessing plant are given. In the comparison of variants of the process, with and without oxygen, the former is given preference.

10927 (KFK—4187, pp 115-121) **Development of inert gas washing with R-12 as part of an integrated off-gas system.** Henrich, E. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

As a variant of the low temperature rectification process, the development of a continuous non-pressurized inert gas washer with the fluorine/chlorine hydrocarbon R-12 (freon) is described for the krypton separation from waste gas in a reprocessing plant. In the present state of investigations, one expects that this process, together with the other cleaning steps of the waste gas section, can contribute to the improvement of the safety, the simplification of the technique and therefore both to the reliability and to the economy of the process.

10928 (KFK—4187, pp 123-135) **Adsorptive Kr separation from the off-gas, taking trace impurities into account.** Ringel, H.; Assmann, G. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Jan 1987. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751298/JAW. (PWA—92/86; CONF-8511320—).

From KfK seminar on Krypton separation from waste gas of a reprocessing plant by low temperature rectification; Karlsruhe, F.R. Germany (21 Nov 1985).

The system of krypton separation from the waste gas of the reprocessing plant for nuclear fuels developed at the Nuclear Research Centre Juelich is described. After waste gas cleaning and pre-separation from H/sub 2/O and NO/sub x/, the krypton, together with xenon, is adsorbed at low temperatures (-130 to -160/sup 0/C) on active carbon and then separated from it chromatographically in the regeneration process of the adsorption columns.

10929 (KFK—4190) **New developments in the field of reprocessing. Selected seminar papers.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie). Apr 1987. 38p. (PWA—11/87; CONF-8403259—). Special print from Atomkernenerg. Kerntech. (1985) v. 47(2), (1986) v. 48(1,3,4).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

Seven of the twenty eight lectures delivered at the above meeting were selected for this report. They are concerned with experience of operation at the Karlsruhe reprocessing plant (WAK) and at various experimental structures of the PUREX process, with analytical inspection of individual steps of processes and improved process design, with questions on materials and corrosion and with methods of decontamination. The lectures were entered separately in the INIS and ENERGY databases.

10930 (KFK—4190, pp 3-8) **Operating experience with the Karlsruhe reprocessing plant.** Schueller, W. (Wiederaufbereitungsanlage Karlsruhe Betriebsgesellschaft m.b.H., WAK, Eggenstein-Leopoldshafen, Germany, F.R.). Apr 1987. Special print from Atomkernenerg. Kerntech. (1985) v. 47(2) p. 77-82. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

The Wiederaufarbeitungsanlage Karlsruhe (WAK) pilot plant, commissioned in 1971, has the longest operating record of all lightwater reactor reprocessing plants. It provides a solid basis of experience for the planning and operation of the first industrial reprocessing plant in the Federal Republic of Germany. The paper gives a summary of 19 reprocessing campaigns and of 9 intervention programs devoted to plant maintenance, process improvements, and equipment development. It also summarizes our experience with process control equipment and sampling devices. In addition to routine process control and safeguarding fissile material inventory, the analytical staff services highly versatile facilities for evaluation of design data for the industrial plant. The safety record of the plant is outstanding.

10931 (KFK—4190, pp 9-12) **Uranium extraction cycle in the TEKO facility.** Eiben, K.; Zimmermann, H. (Wiederaufbereitungsanlage Karlsruhe Betriebsgesellschaft m.b.H., WAK, Eggenstein-Leopoldshafen, Germany, F.R.). Apr 1987. Special print from Atomkernenerg. Kerntech. (1985) v. 47(2) p. 83-86. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

Construction and operation of a complete extraction cycle for simulation of the Purex process with depleted uranium at the TEKO facility (Teststand fuer Grosskomponenten, testing facility for full-scale components) has provided valuable information for the design of extraction equipment for a commercial reprocessing plant. This applies particularly to pulsed HA and C columns where typical hydrodynamic phenomena and problems, in addition to scale-up tasks, had to be solved. The working behaviour of the individual apparatus and of the entire equipment has been tested in detail. Simulation of typical malfunctions of the plant have been carried out. New ways of processing (electrolytic reoxidation, removing tributyl phosphate from aqueous raffinates by steam stripping, direct and careful distillation of the organic solvent, use of a mechanical pulsator in the pulsed columns) have been assessed under plant conditions.

10932 (KFK—4190, pp 13-16) **Analysis of nitrogen-containing compounds in Purex solutions.** Ertel, D. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie). Apr 1987. Special print from Atomkernenerg. Kerntech. (1985) v. 47(2) p. 87-90. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

The analytical assay of nitric acid, nitrous acid and hydrazine, and also of hydrazoic acid, hydroxylamine and ammonium in Purex process solutions is described and characterized using specific analytical methods, with typical concentrations quoted. The first three compounds, being familiar constituents in the Purex process, are analyzed on a routine basis using proven methods. Novel analytical approaches have been tested and introduced at the author's Institute to assay the other nitrogen compounds. Their application in the analysis of actual Purex process solutions gave interesting preliminary results, e.g. on the behaviour and concentrations of HN/sub 3/ and NH/sub 4//sup +/ found in the Purex process.

10933 (KFK—4190, pp 17-19) **On the necessity for chemical microdimensional analysis of radioactive by-products in the nuclear fuel cycle.** Baumgaertner, F.; Henkelmann, R. (Technische Univ. Muenchen, Garching, Germany, F.R. Inst. fuer Radiochemie). Apr 1987. Special print from Atomkernenerg. Kerntech. (1985) v. 47(2) p. 91-93. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

The dissolver residues arising from delayed precipitation from light-water reactor fuel solution have been shown to consist of metal colloids. This has been revealed using photographic and X-ray fluorescence analyses of the dissolver residues incorporating high resolution electron microprobe techniques. Evaluation of a number of microparticles showed the identical chemical composition of the ϵ-phase, known as 'white inclusions' from fast breeder fuel elements. These microanalyses also indicated that precipitates of oxidic phases of Mo and Tc, previously believed to be almost insoluble metal acids, could also have been formed as radiation-induced oxidation products of primary metallic precipatates. Moreover, segregation of colloidal silver halides has been observed in fission products, their agglomeration as microscopic AgX bodies possessing a crystal symmetry already well established macroscopically.

10934 (KFK—4190, pp 20-26) **Radiochemical investigations on corrosion of valve metals.** Marx, G.; Bestanpouri, A.; Erben, W.; Wegen, D. (Freie Univ. Berlin, Germany, F.R. Inst. fuer Anorganische und Analytische Chemie). Apr 1987. Special print from Atomkernenerg. Kerntech. (1986) v. 48(1) p. 16-22. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

In order to determine the applicability of valve metals of the Purex process, the corrosion behaviour of these elements was investigated under practical conditions. For these investigations a new technique, based upon the combined application of neutron activation analysis and normal electrochemical procedures, was developed and applied to questions of particular interest. This method had the advantage that it can distinguish between the amount of material directly dissolved due to corrosion from that due to incorporation in the oxide layer. It has been proved that not only isotopic but also non-isotopic radionuclides can be successfully used for this determination. Anodic potentiodynamic and potentiostatic measurements on Hf, Ti and Ta have shown that under the practical conditions employed in the Purex process, any metal removal can be neglected. A plutonium content of up to 2.2 g/l even stabilized the oxide layer towards corrosion by forming mixed oxides of Hf and Pu. The influence of F-ions on the stability of the oxide layer has been systematically investigated and techniques evolved for masking these corroding anions.

10935 (KFK—4190, pp 31-35) **New concept for product refining in the Purex process.** Henrich, E.; Bauder, U.; Marquardt, R.; Druckenbrodt, W.G.; Wittmann, K. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie; Alpha Chemie und Metallurgie G.m.b.H., ALKEM, Hanau, Germany, F.R.). Apr 1987. Special print from Atomkernenerg. Kerntech. (Oct 1986) v. 48(4) p. 241-245. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

In actual Purex plants the products are refined in additional solvent extraction cycles. Crystallization of uranyl and plutonyl nitrate from aqueous nitric acid solution is proposed as a potentially simpler product refining concept. Suitable crystallization conditions are being investigated in the laboratory using simulated and actual process solutions. A thorough removal of mother liquor is an essential purification step and well washed crystals usually contain less than one percent of an individual impurity. Crystallization simultaneously comprises a product concentration step. Hexavalent uranium can be separated from lower-valent plutonium. An outline of an integrated processing concept is given. Product refining by crystallization is compact; recycling of mother liquor plus wash acid prevents product loss and the generation of additional waste streams.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 10966, 11573, 12087, 12089, 12090, 12091

10936 (DOE/RL—87-11) **Spent fuel storage requirements 1987.** (USDOE Richland Operations Office, WA). Sep 1987. Contract AC06-76RL01830. 69p. (PNL—6330). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003716/JAW.

Historical inventories of spent fuel and utility estimates of future discharges from US commercial nuclear reactors are presented through the year 2005. The ultimate needs for additional storage capacity are estimated. These estimtes are based on the maximum capacities within current and planned at-reactor facilities and on any planned transshipments of fuel to other reactors or facilities. Historical data through December, 1986, and projected discharges through the end of reactor life are used in this analysis. The source data was supplied by the utilities to the DOE Energy Information Administration (EIA) through the 1987 RW-859 data survey. 14 refs., 4 figs., 9 tabs.

10937 (PNL—6364) **Control of degradation of spent LWR [light-water reactor] fuel during dry storage in an inert atmosphere.** Cunningham, M.E.; Simonen, E.P.; Allemann, R.T.; Levy, I.S.; Hazelton, R.F. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 148p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003982/JAW.

Dry storage of Zircaloy-clad spent fuel in inert gas (referred to as inerted dry storage or IDS) is being developed as an alternative to water pool storage of spent fuel. The objectives of the activities described in this report are to identify potential Zircaloy degradation mechanisms and evaluate their applicability to cladding breach during IDS, develop models of the dominant Zircaloy degradation mechanisms, and recommend cladding temperature limits during IDS to control Zircaloy degradation. The principal potential Zircaloy cladding breach mechanisms during IDS have been identified as creep rupture, stress corrosion cracking (SCC), and delayed hydride cracking (DHC). Creep rupture is concluded to be the primary cladding breach mechanism during IDS. Deformation and fracture maps based on creep rupture were developed for Zircaloy. These maps were then used as the basis for developing spent fuel cladding temperature limits that would prevent cladding breach during a 40-year IDS period. The probability of cladding breach for spent fuel stored at the temperature limit is less than 0.5% per spent fuel rod. 52 refs., 7 figs., 1 tab.

10938 **(PNL—6365) Evaluation of cover gas impurities and their effects on the dry storage of LWR [light-water reactor] spent fuel.** Knoll, R.W.; Gilbert, E.R. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 35p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003983/JAW.

The purposes of this report are to (1) identify the sources of impurity gases in spent fuel storage casks; (2) identify the expected concentrations and types of reactive impurity gases from these sources over an operating lifetime of 40 years; and (3) determine whether these impurities could significantly degrade cladding or exposed fuel during this period. Four potential sources of impurity gases in the helium cover gas in operating casks were identified and evaluated. Several different bounding cases have been considered, where the reactive gas inventory is either assumed to be completely gettered by the cladding or where all oxygen is assumed to react completely with the exposed fuel. It is concluded that the reactive gas inventory will have no significant effect on the cladding unless all available oxygen reacts with the UO_2 fuel to produce U_3O_8 at one or two cladding breaches. Based on Zircaloy oxidation data, the oxygen inventory in a fully loaded pressurized water reactor cask such as the Castor-V/21 will be gettered by the Zircaloy cladding in about 1 year if the peak cladding temperature within the task is ≳300°C. Only a negligible decrease in the thickness of the cladding would result. 24 refs., 4 tabs.

10939 **Performance characteristics of a continuous-flow fluidic pump.** Robinson, S.M.; Counce, R.M.; Smith, G.V. (Chemical Technology Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Industrial and Engineering Chemistry Research;* **26**: No. 8, 1698-1703(Aug 1987). Contract AC05-84OR21400.

The fluidic pump is a type of positive-displacement pump in which basic fluid mechanics phenomena are utilized to eliminate valves and other moving parts that are exposed to the fluid being transferred. The version described in this article is powered by gas pressure serving as gas pistons and is virtually maintenance-free. It utilizes two displacement vessels and is designed to produce a steady and continuous liquid flow. This type of pump may be very useful for the transfer of radioactive or hazardous liquids where mechanical maintenance may be difficult or exposure of personnel to the fluid is undesirable. This paper presents experimental and model-predicted characteristics of such systems. The effects of several geometric parameters and operating conditions on the performance of the pump are briefly discussed.

10940 **A risk-weighted strategy of statistical sampling.** Seiler, F.A. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, P.O. Box 5890, Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* **16**: 129-133(Jul 1987). (CONF-870713—). Contract AC04-76EV01013.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Traditionally, sampling plans have been based either on randomized sampling or have relied on best engineering judgment. Here, a new strategy is proposed using differences in the risks associated with different units of the sampling set (e.g., a waste barrel, a unit surface at a work or contamination site) to influence the frequency of sampling. This results in a sampling plan which, unlike conventional random sampling, can form the basis for tests involving risk considerations. Sampling rates are higher for units which pose a higher risk, while maintaining a sufficient rate for units with a much smaller risk. This strategy is presented here in a general form and examples are given in the area of transport and disposal of nuclear waste.

10941 **The issue resolution process in the Civilian Radioactive Waste Transportation Program.** Holm, J.A.; Denny, S. (U.S. Dept. of Energy, Chicago, IL). *Journal of Nuclear Materials Management;* **16**: 114-118(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Civilian Radioactive Waste Management (OCRWM) Program consists of various technical and institutional program activities which engender concern from the general public and from policymakers at federal, state, and local levels. Most familiar are the concerns centered around selection of a site for a repository; however, the transportation portion of the OCRWM program also engenders similar concerns for safety, efficiency and effectiveness. The major Transportation institutional issues were detailed in the Institutional Plan, issued in 1986, and include topics such as liability, defense waste, routing, emergency response, risk identification and mitigation, cash integrity, inspection and enforcement of high-level waste shipments and use of overweight trucks as part of the modal mix. This paper will define the process being used to identify and resolve institutional issues, show how the technical and institutional issues interface and are addressed, and briefly describe four specific activities which illustrate the process of resolving institutional issues in the Transportation program.

10942 **Public concerns about radioactive material transportation can be reduced by effective communication of engineering data.** Mc Clure, J.D.; Luna, R.E. (Risk Assessment and Transportation System Planning Div., Sandia National Labs.). *Journal of Nuclear Materials Management;* **16**: 266-271(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This paper presents information concerning the safety of transporting radioactive materials (RAM). This evaluation is supported by an examination of data for actual accidents and incidents that have occurred with RAM transport, a study of the regulatory test procedures used to certify RAM packagings and the comparison of RAM transport with that of other hazardous materials. A number of studies are summarized that show that RAM transportation has been a low risk operation for approximately four decades. Where appropriate, RAM transport statistics are compared with the statistics of other hazardous materials. This engineering information can be used by federal, state and local officials and public interest groups to assess the relative risk of RAM transportation on a national scale and in their local jurisdictions. The organization of engineering data in an orderly and logical fashion and the presentation of this data to government agencies and members of the public can be used in an attempt to allay fears about the safety of RAM transportation.

10943 **Base technology development enhances state-of-the-art in meeting performance requirements.** Freedman, J.M.; Allen, G.C. Jr.; Luna, R.E. (Transportation Systems Development Dept., Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* **16**: 263-265(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Sandia National Laboratories (SNL) has responsibility to the United States Department of Energy (DOE) for baseline technology to support the design of radioactive material transportation packages. To fulfill this responsibility, SNL works with industry, government agencies, and national laboratories to identify and develop state-of-the-art technology required to design and test safe, cost-effective radioactive materials packages. Principal elements of the base technology program include: 1) analysis techniques, 2) testing, 3) subsystem and component development, 4) packaging systems development support, and 5) technical support for policy development. These program elements support a systems approach for meeting performance requirements and assure that there is a sound underlying technical basis for both transportation packaging design and associated policy decisions. Highlights from the base technology program included in this paper are testing, design and analysis methods, advanced materials, risk assessment and logistics models, and transportation package support.

10944 **TMI-2 transportation program - Design considerations for the NUPAC 125-B cask handling and loading/unloading equipment.** Schmoker, D.S.; Schmitt, R.C.; Barkanic, R.J. (Nuclear Packaging, Inc., Federal Way, WA). *Journal of Nuclear Materials Management;* **16**: 255-262(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Removal, transport and receipt of core debris from the damaged reactor at Three Mile Island Unit 2 (TMI-2) required the design of transport cask handling and "dry" loading and unloading equipment. The system for "dry" (not underwater) loading of the transport cask includes; 1) equipment for handling the cask, 2) equipment for loading core debris canisters into the cask at TMI, and 3) equipment for removing the canisters in a hot cell facility. This paper reviews the technical design considerations operational parameters and summarizes lessons learned in the design, testing, startup and use of the equipment provided for the TMI-2 Transportation Program.

10945 **Update of Nuclear Waste Policy Act transportation activities.** Callaghan, E.F. (Office of Civilian Radioactive Waste Management, U.S. Dept. of Energy, Washington, DC 20585). *Journal of Nuclear Materials Management;* 16: 251-254(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

As directed by the Nuclear Waste Policy Act of 1982 (NWPA), the Department of Energy (DOE) is developing a nationwide system for transporting spent nuclear fuel and high-level radioactive waste from commercial power plants to deep geologic repositories for disposal. Plans for the transportation system will consider the following factors: the President's 1985 decision to colocate some defense high-level waste with commercial waste in a repository, the NWPA requirement that the private sector be used to the fullest extent possible in developing and operating the system, and the possible approval by Congress of the DOE's proposal for a Monitored Retrievable Storage (MRS) facility, submitted in March 1987. (The MRS, if approved, would provide for the consolidation, packaging, and perhaps the temporary storage of spent fuel from reactors.) The "Transportation Business Plan", published in January 1986, reflects these considerations. The transportation system, when operational, will consist of two elements: (1) the cask system, which includes the transportation casks, the vehicular conveyances, tie-downs, and associated equipment for handling the casks; and (2) the transportation support system which is comprised of facilities, equipment, and services to support waste transportation. Development of the transportation system incorporates the following work elements: operational planning, support systems development, cash system development, systems analysis, and institutional activities. This paper focusses on the technical aspects of the system.

10946 **Rigid performance requirements assure public safety by regulations.** Nickell, R.E.; Glass, R.E. (Applied Science and Technology, Poway, CA). *Journal of Nuclear Materials Management;* 16: 246-250(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Title 10, Part 71 of the Code of Federal Regulations (10 CFR 71) provides a set of prescriptive performance test requirements for spent nuclear fuel and high-level waste transport packaging containment systems. The hypothetical accident conditions, which involve a sequence of impact, puncture, fire, and water immersion events, are referred to as rigid because of their extremely prescriptive nature. These hypothetical accident events have now been placed within the context of real transportation accidents, at least for conventional austenitic stainless steel/ lead gamma shielded cask designs. The assurance of public safety, including the issue of safety margin for very severe accident events is discussed in this paper for both conventional and innovative cask design concepts. A particular risk assessment approach that follows from work at the Lawrence Livermore National Laboratory is suggested.

0510 Marketing, Economics, And By-products

10947 (INIS-mf—11089, pp 67) **Review of magnetic fusion reactor engineering - particularly rotamak.** Ebeling, D.R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

0520 Waste Management

REFER ALSO TO CITATION(S) 10909, 10916, 10917, 10940, 11051, 11051, 11053, 11819, 12044, 12518, 12521, 12525

10948 **(AD-A—185060/1/XAB) Dependence of expansion of a salt-saturated concrete on temperature and mixing and handling procedures. Final report.** Wakeley, L.D. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.). Jul 1987. 31p. (WES/TR/SL—87-20). NTIS, PC A03/MF A01.

In experiments with an expansive salt-saturated concrete (ESC), time of setting was controlled by amount of sodium citrate used. The rheological and physical properties required of ESC were determined by its intended use, in an underground repository for radioactive wastes in bedded rock salt. These properties, including a long working time and low air content, could not be achieved using conventional high-range water-reducing admixtures, such as melamine or naphthalene formaldehyde condensates. Within a fixed range of citrate percentages, expansivity of the concrete was proportional to the amount of citrate used. The desired level of expansion resulted from delaying formation of ettringite until after formation of a rigid structure in the paste. Expansive potential was diminished by warmer temperatures of mixing curing, and by repeated episodes of mixing or disturbance during the extended period of workability (up to 4 hr). These variables should be considered in plans for field placement of this or any expansive concrete. The potential for durability of this concrete in the environment for which it was formulated cannot be gauged by those properties commonly used as indicators of durability for conventional concrete in surface environments. Low permeability and minimal reaction to brine are interrelated factors which may better indicate durability than do traditionally cited properties such as compressive strength or resistance to cyclic phenomena.

10949 **(AERE-R—12496) Measurements of /sup 137/Cs diffusion coefficients in an epoxide resin.** Burnay, S.G.; Dyson, J.R. (UKAEA Harwell Lab. Materials Development Div.; Department of the Environment, London (UK)). Sep 1987. 17p. (DOE-RW—87.060). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751824/JAW.

A technique for the preparation of thin membranes of an epoxide resin for permeation experiments has been developed. Preliminary results indicate that with membranes approx. 0.1 mm thick, the damage introduced by the preparation process affects the values of the diffusion coefficient obtained from such experiments.

10950 **(ANL/EES-TM—339) Container materials for isolation of radioactive waste in salt.** Streicher, M.A.; Andrews, A. (eds.). (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 56p. (CONF-8609144—). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004491/JAW.

From Workshop on alternative materials for the waste package container; Columbus, OH, USA (25 Sep 1986).

The workshop reviewed the extensive data on the corrosion resistance of low-carbon steel in simulated salt repository environments, determined whether these data were sufficient to recommend low-carbon steel for fabrication of the container, and assessed the suitability of other materials under consideration in the SRP. The panelists determined the need for testing and research programs, recommended experimental approaches, and recommended materials based on existing technology. On the first day of the workshop, presentations were made on waste package requirements; the expected corrosion environment; degradation processes, including a review of data from corrosion tests on carbon steel; and rationales for container design and materials, modeling studies, and planned future work. The second day was devoted to a panel caucus, presentation of workshop findings, and open discussion. 76 refs., 2 figs., 3 tabs.

10951 (BMI/ONWI—664) Thermomechanical analyses of conceptual repository designs for the Paradox and Permian Basins. Loken, M.C.; Callahan, G.D.; Svalstad, D.K.; Wagner, R.A. (RE/SPEC, Inc., Rapid City, SD (USA)). Nov 1987. Contract AC02-87CH10290;AC02-83CH10140. 505p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE88003705/JAW.

The potential repositories are designed to accommodate all waste forms emplaced at various thermal loadings; specifically, commercial high-level waste (30 W/m^3), spent fuel (15 W/m^3), defense high-level waste (20 W/m^3), and remote-handled and contact-handled transuranic nonheat-generating waste. The study evaluates the design parameters, primarily thermal loading, based on a comparison of calculable thermomechanical parameters with prescribed performance constraints. This evaluation was accomplished by numerical simulation using finite element techniques of the canister, disposal room, and repository regions of each potential site. Important thermal and thermomechanical results were compared with their prescribed constraint or limit value. All of the performance constraints were satisfied at the Davis Canyon site in the Paradox Basin for commercial high-level waste, spent fuel, and defense high-level waste at areal thermal loadings of 20 W/m^3, 15 W/m^3, and 20 W/m^3, respectively. Similarly, for the Deaf Smith County site in the Permian Basin, commercial high-level waste, spent fuel, and defense high-level waste thermal loadings of 13.5 W/m^3, 8.5 W/m^3, and 6.0 W/m^3, respectively, satisfied all of the performance constraints. 89 refs., 64 figs., 22 tabs.

10952 (BMI/ONWI—667) Quarterly brine migration data report, July-September 1985: Nuclear waste repository simulation experiments (brine migration), Asse Mine of the Federal Republic of Germany. Eckert, J.L.; Kalia, H.N.; Coyle, A.J. (Battelle Memorial Inst., Hereford, TX (USA). Office of Nuclear Waste Isolation). Nov 1987. Contract AC02-83CH10140. 265p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88003963/JAW.

The purpose of this report is to provide field test data for various analysts and to refine and support numerical models on brine migration, room closure, and other thermomechanical behaviors of salt subjected to heat and gamma radiation. The Asse Data Acquisition System is used to collect data on a 24-hour basis. The data are recorded on magnetic tapes, which are sent to ONWI. The data that are not recorded on magnetic tapes are collected manually on a daily or weekly basis. This includes the measurements for brine collection, room closure, and salt pressures from flat cells. The brine migration and geotechnical data collected from May 1983 through September 1985 are presented in this brine migration data report. The data are presented in two forms: tabular and graphic. The graphs include all the data, whereas the tables present only weekly or monthly readings to keep the list short. The majority of data are generated from the magnetic tapes. However, some data are generated from annual readings, and transcription errors may occur. All data are available through ONWI's Engineering Department on tape or on printed listings for those interested in performing in-depth analyses. 2 refs.

10953 (BMI/ONWI—669) Agriculture-related radiation dose calculations. Furr, J.M.; Mayberry, J.J.; Waite, D.A. (Battelle Memorial Inst., Hereford, TX (USA). Office of Nuclear Waste Isolation). Oct 1987. Contract AC02-83CH10140;AC02-87CH10290. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004645/JAW.

Estimates of radiation dose to the public must be made at each stage in the identification and qualification process leading to siting a high-level nuclear waste repository. Specifically considering the ingestion pathway, this paper examines questions of reliability and adequacy of dose calculations in relation to five stages of data availability (geologic province, region, area, location, and mass balance) and three methods of calculation (population, population/food production, and food production driven). Calculations were done using the model PABLM with data for the Permian and Palo Duro Basins and the Deaf Smith County area. Extra effort expended in gathering agricultural data at succeeding environmental characterization levels does not appear justified, since dose estimates do not differ greatly; that effort would be better spent determining usage of food types that contribute most to the total dose; and that consumption rate and the air dispersion factor are critical to assessment of radiation dose via the ingestion pathway. 17 refs., 9 figs., 32 tabs.

10954 (BMI/ONWI—670) Expected near-field radionuclide transport for nuclear waste repositories at potential salt sites. McNulty, E.G.; Bloom, S.G.; Raines, G.E. (Battelle Memorial Inst., Hereford, TX (USA). Office of Nuclear Waste Isolation). Nov 1987. Contract AC02-87CH10290;AC02-83CH10140. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004145/JAW.

Radionuclide transport analyses were made for seven potentially acceptable salt sites for nuclear waste repositories for commercial high-level waste (CHLW) and spent fuel from pressurized-water reactors (SFPWR). These transport analyses used thermally induced brine volumes at each salt site and curie inventories specific to CHLW and SFPWR waste. The analyses conservatively assumed that the radionuclides would immediately dissolve in available brine even though the expected lifetime of the package exceeds 10,000 years. The average CHLW or average SFPWR waste package is not expected to fail for over 10,000 years. These radionuclide transport analyses predict that any of the seven potentially acceptable salt sites would provide excellent isolation of nuclear waste for radionuclide transport based on the diffusion of brine.

10955 (BMU—1987-156) Possibilities of final disposal of radioactive krypton in the framework of the German radioactive waste management concept. Koehling, A.; Langer, G. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)). Feb 1986. 95p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

Kr-85 can be stored gaseous in gas cylinders or fixed in solid matter like metal-alloys (by ion implantation) or zeolithes. Kr-85 contained in gas cylinders can be stored in above-ground buildings for 100 years, with cooling provided by natural air-convection. Kr-85 fixed in solid matter can also be stored in an above-ground building or in deep geological formations. For an above-ground storage of fixed Kr-85 cooling can be established by natural air-convection, too. Compared with gas cylinders, cooling need not to be performed within a narrow temperature range, and Kr-85 leakage is practically precluded, so that surveillance and control of the storage building could be minimized. Another possibility is to store the canisters with fixed Kr-85 in the transportation casks, as it is done with spent-fuel-elements for interim storage. These casks provide sufficient protection against thermal and mechanical loads. For storage fixed Kr-85 products in a geological repository at present only the Gorleben site is available, because heat generating waste must not be stored in the Konrad mine. A combined storage with high-active waste canisters within the same boreholes should be possible, provided the Kr-85-fixed-product-canisters have the same dimensions and mechanical stability.

10956 (BNL—52081) Immobilization of sodium nitrate waste with polymers: Topical report. Franz, E.M.; Heiser, J.H. III; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). Apr 1987. Contract AC02-76CH00016. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004725/JAW.

This report describes the development of solidification systems for sodium nitrate waste. Sodium nitrate waste was solidified in the polymers polyethylene, polyester-styrene (PES), and water-extendible polyester-styrene (WEP). Evaluations were made of the properties of waste forms containing various amounts of sodium nitrate by leaching immersion in water, measuring compressive strengths and by the EPA Extraction Procedure. Results of the leaching test are presented as cumulative fraction leached (CFL), incremental leaching rate, and average leaching indices (LI). For waste forms containing 30 to 70 wt% sodium nitrate, the CFL ranged from 9.0 x 10^{-3} to 7.3 x 10^{-1} and the LI from 11 to 7.8. After ninety days immersion in water, the compressive strengths ranged from 720 psi to 2550 psi. The nitrate releases from these samples using the EPA Extraction Procedure were below 500 ppM. The nitrate releases from PES waste forms were similar to those

from polyethylene waste forms at the same waste loadings. The compressive yield strengths, measured after ninety-day immersion in water, ranged between 2070 and 7710 psi. In the case of WEP waste forms, only 30 wt% loaded samples passed the immersion test. 23 refs., 24 figs., 12 tabs.

10957 **(CEGB-TPRD/B—0896/R87) Risk assessment methods for radioactive waste disposal: problems associated with the annual risk approach and how to avoid them.** Corbett, J.O. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1987. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751463/JAW.

It is shown that the method of assessing radioactive waste disposal options in terms of the annual risk to the critical group can lead to anomalous results, in which the risk is artificially diluted by averaging it over a number of generations, most of whom are actually unaffected. An alternative approach is proposed, based on the statistical expectation value of the lifetime risk to the critical group, which is not subject to this problem. The two methods are compared by analysing simple mathematical models of the patterns of radiation exposure that may follow closure of a repository; the origins and possible extent of risk dilution are identified and the relative importance of the risk from stochastic and acute effects is discussed. Finally, the problem of applying the proposed alternative method to a realistic analysis is discussed and an approximation scheme in terms of Laplace transforms is suggested.

10958 **(CONF-870306—70) Modeling of low-level-waste disposal for environmental impact analysis.** Yu, C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002832/JAW.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

A computer model was developed to analyze environmental impacts resulting from disposal of both radioactive and chemical wastes. The model simulates a waste-disposal system and includes infiltration through disposal cell caps, source leach rates, and solute transport in geologic media. The solute transport model used is a modified version of an analytical code originally developed at Oak Ridge National Laboratory. The solute transport code was modified based on the Group-Transfer Concentration concept developed by the author. The original model is applicable only to homogeneous media under saturated conditions, but the modified model extends applicability to nonhomogeneous media (layered soils and fractures) and partially saturated conditions. The modified model has broader applicability, e.g., it can be applied to both humid and arid waste-disposal sites, and it is also more practical for environmental impact analysis. 22 refs., 2 tabs.

10959 **(CONF-870859—26) Assessing the performance of engineered barriers and materials for confinement of low-level radioactive waste.** Gilbert, T.L.; Camasta, S.F.; Meshkov, N.K. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003093/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

The overall performance of a low-level radioactive waste disposal facility is determined by the facility design and site environment. In order to take credit for facility design features, such as engineered barriers, methods for assessing the performance of these features are needed. The objective of the work summarized in this status report is to develop such methods. It involves deriving performance criteria from the performance objective; identifying models and parameters for estimating the performance; and reviewing available methods and data for determining parameter values.

10960 **(CONF-870859—27) Evaluation of waste treatment technologies by LLWDDD [Low-Level Waste Disposal Development and Demonstration] Programs.** Kennerly, J.M.; Williams, L.C.; Dole, L.R.; Genung, R.K. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002302/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

Waste treatments are divided into four categories: (1) volume reduction; (2) conditioning to improve waste form performance; (3) segregation to achieve waste reduction; and (4) separation to remove radioactive (or hazardous) constituents. Two waste treatment demonstrations are described. In the first, volume reduction by mechanical means was achieved during the supercompaction of 300 55-gal drums of solid waste at ORNL. In the second demonstration, conditioning of waste through immobilization and packaging to improve the performance of the waste form is being evaluated. The final section of this paper describes potential scenarios for the management of uranium-contaminated wastes at the Y-12 Plant in Oak Ridge and emphasizes where demonstrations of treatment technology will be needed to implement the scenarios. Separation and thermal treatment are identified as the principal means for treating these wastes. 15 figs.

10961 **(CONF-870859—28) Changing needs in a waste information management system: A disposer's viewpoint.** Fauver, S.L. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1987. Contract AC08-84NV10327. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003386/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

An enhanced radioactive waste management information system (RWMIS) is currently under development to accommodate more specific reporting requirements. Radioactive waste management project (RWMP) has recently completed a draft revision of its Operational Radioactive Defense Waste Management Plan for the Nevada Test Site which identifies NTS waste acceptance criteria and revised data requirements for waste generators. Emphasis shifts to the characterization of individual waste packages. RWMP proposes that the waste generator number individual waste packages in a manner which identifies the generator, waste stream, container type, and method of treatment or stabilization. A listing of radionuclides and concentrations will be required, as well as physical and chemical data specific to each waste package. Analytical methods and techniques used for waste package characterization must be detailed by each generator in their quality assurance plan which is reviewed by DOE Nevada Operations Office.

10962 **(CONF-870859—29) Mixed waste disposal facility at the Nevada Test Site.** Dickman, P.T.; Kendall, E.W. (Science Applications International Corp., Las Vegas, NV (USA); Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1987. Contract AC08-84NV10327. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003388/JAW.

From 9. annual low-level radioactive waste management program conference; Denver, CO, USA (25 Aug 1987).

This report provides a brief overview of the history and planning for a proposed mixed waste disposal site on the Nevada Test Site. 8 figs.

10963 **(CONF-871237—1) Effect of ionizing radiation on moist air systems.** Reed, D.T.; Van Konynenburg, R.A. (Argonne National Lab., IL (USA); Lawrence Livermore National Lab., CA (USA)). 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002897/JAW.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1987).

The radiation chemistry of nitrogen/oxygen/water systems is reviewed. General radiolytic effects in dry nitrogen/oxygen systems are relatively well characterized. Irradiation results in the formation of steady state concentrations of ozone, nitrous oxide and nitrogen dioxide. In closed systems, the concentration observed depends on the total dose, temperature and initial gas composition. Only three studies have been published that focus on the radiation chemistry of nitrogen/oxygen/water homogeneous gas systems. Mixed phase work that is relevant to the gaseous system is also summarized. The presence of water vapor results in the formation of nitric acid and significantly changes the chemistry observed in dry air systems. Mechanistic evidence from the studies reviewed

are summarized and discussed in relation to characterizing the gas phase during the containment period of a repository in tuff.

10964 **(CONF-880201—1-Summ.) Use of a United States mid-Pacific Island territory for a Pacific Island Repository System (PIRS): Extended summary.** Forsberg, C.W. (Oak Ridge National Lab., TN (USA)). Aug 1987. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87014940/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

The concept of using a mid-ocean island for a geologic high-level waste repository was investigated. The technical advantages include geographical isolation and near-infinite ocean dilution as a backup to repository geological waste isolation. The institutional advantages are reduced siting problems and the potential of creating an international waste repository. Establishment of international waste repository would allow cost sharing, aid US nonproliferation goals, and assure proper disposal of spent fuel from developing countries. The major uncertainties in this concept are rock conditions at waste disposal depths and costs. 13 refs., 2 tabs.

10965 **(CONF-880201—2) PRESTO-II computer code for safety assessment on shallow land disposal of low-level wastes.** Uslu, I.; Fields, D.E.; Yalcintas, M.G. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002615/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, USA (26 Feb 1988).

The PRESTO-II (Prediction of Radiation Effects from Shallow Trench Operations) computer code has been applied for the following sites; Koteyli, Balikesir and Kozakli, Nevsehir in Turkey. This site selection was based partially on the need to consider a variety of hydrologic and climatic situations, and partially on the availability of data. The results obtained for the operational low-level waste disposal site at Barnwell, South Carolina, are presented for comparison. 6 refs., 2 figs., 1 tab.

10966 **(CONF-8709104—10) Calculation of health risks from spent-nuclear-fuel transportation accidents.** Chen, S.Y.; Yuan, Y.C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002935/JAW.

From ANS topical conference on population exposure from nuclear fuel cycle; Oak Ridge, TN, USA (15 Sep 1987).

Models developed to analyze potential radiological health risks from various accident scenarios during transportation of spent nuclear fuels are described. The models are designed both for detailed route-specific risk analyses and for use in conducting overall risk analyses for route selection and related decision-making activities. The radiological risks calculated include individual dose commitments, collective dose commitments, and long-term (100-year) environmental dose commitments to a population following release of radioactivity. To facilitate route-specific analysis, a state-level database was developed and incorporated into the model. Route-specific analysis is demonstrated by the calculation of radiological risks resulting from various accident scenarios, as postulated by the recent US Nuclear Regulatory Commission Modal Study, for four representative states selected from various regions of the United States. 10 refs., 3 figs., 3 tabs.

10967 **(CONF-8709194—1) A method for evaluating the effectiveness of site characterization measurements.** Ditmars, J.D. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002951/JAW.

From Conference on land disposal of hazardous waste; Cambridge, UK (9 Sep 1987).

A quantitative approach for evaluating the effectiveness of site characterization measurement activities is developed and illustrated with an example application to hypothetical measurement schemes at a potential geologic repository site for radioactive waste. The method is a general one and could also be applied at sites for underground disposal of hazardous chemicals. The approach presumes that measurements will be undertaken to support predictions of the performance of some aspect of a constructed facility or natural system. It requires a quantitative performance objective, such as groundwater travel time or contaminant concentration, against which to compare predictions of performance. The approach recognizes that such predictions are uncertain because the measurements upon which they are based are uncertain. The effectiveness of measurement activities is quantified by a confidence index, β, that reflects the number of standard deviations separating the best estimate of performance from the predetermined performance objective. Measurements that reduce the uncertainty in predictions lead to increased values of β. 5 refs., 4 figs.

10968 **(DOE/AL/10752—37) Exhaust stack monitoring issues at the Waste Isolation Pilot Plant.** Rodgers, J.C. (New Mexico Health and Environment Dept., Santa Fe (USA). Environmental Evaluation Group). Nov 1987. Contract AC04-78AL10752. 116p. (EEG—37). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88004200/JAW.

This report outlines the problems of obtaining valid, representative samples of, and continuously monitoring for, radioactive particulates in the discharge air from the underground disposal facilities at WIPP. There appears to be serious problems with the presently installed systems. Chapter 1 of the report provides an overview of current perspective on the major issues. Principal conclusions of the overview are that the present sampling locations are not optimum for the intended purpose; that the chosen probe design is not capable of meeting requirements for delivery of a representative sample to the detectors; and that the proposed test plan for the flow conditioning and monitoring system is seriously flawed. Chapter 2 is a summary of the major findings and recommendations of a peer review. The review suggested that the proposed flow conditioning concepts were likely to be an unworkable substitute for having adequate duct length between major disturbances in flow and the sampling or monitoring locations; that the use of probes of simpler design with large diameter inlet nozzles feeding short transmission lines would provide superior performance; and that conditions for monitoring discharge air would be far better ahead of the collar in the exhaust shaft than any location downstream. Chapter 3 contains the detailed technical basis for a conceptual design, and a proposed sample extraction system for the stack discharge location. 36 refs., 23 figs., 4 tabs.

10969 **(DOE/HWP—28) Microwave-assisted chemical process for treatment of hazardous waste: Annual report.** Varma, R.; Nandi, S.P.; Cleaveland, D.C. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 28p. (ANL—87-20). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002361/JAW.

Microwave energy provides rapid in situ uniform heating and can be used to initiate chemical processes at moderate temperatures. We investigate the technical feasibility of microwave-assisted chemical processes for detoxification of liquid hazardous waste. Trichloroethylene, a major constituent of waste streams, was selected for this detoxification study. Experiments were performed to investigate the oxidative degradation of trichloroethylene over active carbons (with and without catalysts) in air streams with microwave in situ heating, and to examine the feasibility of regenerating the used carbons. This study established that trichloroethylene in a vapor stream can be adsorbed at room temperature on active carbon beds that are loaded with Cu and Cr catalysts. When the bed is heated by a microwave radiation to moderate temperatures ($<400°C$) while a moist air stream is passed through it, the trichloroethylene is readily converted into less-noxious products such as HCl, CO, CO_2 and $C_2H_3Cl_3$. Conversion higher than 80% was observed. Furthermore, the used carbon bed can be conveniently regenerated by microwave heating while a moist-N_2 or moist-air stream is passed through the bed. 4 refs., 5 figs., 10 tabs.

10970 **(DOE/HWP—29) Improved treatment/disposal of reactive metals: Annual report.** Rajan, J.B.; Kumar, R.; Vissers, D.R. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 20p. (ANL—87-39). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002477/JAW.

This study was conducted to develop improved treatment/disposal techniques for reactive metals. We converted the reactive

metal to a glass form by reacting it with silica sand, perhaps along with other additives to impart the desired mechanical and chemical integrity to the waste form. A high soda silicate glass was selected as the most desirable glass form for waste sodium disposal. Differential thermal analyses (DTA) with varying compositions of sodium oxide, silicon dioxide, calcium oxide, and magnesium oxide showed that the primary glass-forming reactions occur at less than 300°C; for the well mixed samples used in DTA tests, there were no additional thermal effects as the temperature was raised to 1260°C, indicating that the glass-forming reaction was essentially completed in a very short time. Samples of sodium disilicate glass were tested for leachability of sodium from them into aqueous solutions. 6 refs., 7 figs.

10971 **(DOE/LLW—66T) The 1986 state-by-state assessment of low-level radioactive wastes received at commercial disposal sites.** (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1987. Contract AC07-76ID01570. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004368/JAW.

The data are grouped and presented by compact regions. The data include activity and volume by waste classes, generator type, and disposal site. The report uses the volume of low-level waste reported as received at each commercial disposal site as the national baseline figure. A volume of 1,804,998 cubic feet (51,113 cubic meters) of radioactive waste containing 233,726 curies of activity was reported disposed at the commercial sites in 1986. The total volume and curie values tabulated for each state were obtained directly from the commercial disposal site operators. The total is the sum of the volume and radioactivity reported by Chem Nuclear Systems, Inc., and US Ecology for each state. Sixty-three percent of low-level waste volumes disposed at commercial sites was assigned to the state of origin. These volumes represent those disposed at Beatty and Barnwell disposal sites. Thirty-seven percent, or 665,066 cubic feet (18,831 cubic meters), of the waste disposed in the US in 1986 went to the Richland site. 8 refs., 75 figs., 4 tabs.

10972 **(DOE/NE/44139—43) West Valley Demonstration Project: Public information plan: Objectives, 1988.** Hoffman, W.D. (Nuclear Fuel Services, Inc., West Valley, NY (USA)). 30 Sep 1987. Contract AC07-81NE44139. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003617/JAW.

This report describes the objectives and proposed activities of the public information program. Included are statements of purpose, goals, approach, and methods of implementation. This office deals with local, state, and federal agencies to inform them on the status of this demonstration project. (TEM)

10973 **(DOE/NV/10270—14) Preliminary site characterization radiological monitoring plan for the Nevada Nuclear Waste Storage Investigations Project, Yucca Mountain Site.** (Science Applications International Corp., Las Vegas, NV (USA)). Mar 1987. Contract AC08-83NV10270. 81p. (SAIC—86/8007). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004208/JAW.

The activities described in this plan occur in the early phases of site characterization. This document presents the Preliminary Site Characterization Radiological Monitoring Plan (PSCRMP) for collecting and evaluating data in support of the NNWSI Project. The PSCRMP defines and identifies control procedures for the monitoring activities. The PSCRMP activity will utilize integrating radon monitoring devices, a continuous radon monitor, and a particulate air sampler. These instruments will be used to establish the baseline radioactivity and/or radioactivity released due to early site characterization activities. The sections that follow provide a general project description, the specifics of the monitoring program, and the practices that will be employed to ensure the validity of the collected data by integrating quality assurance into all activities. Section 2 of this document describes the regulatory base of this document. Section 3 describes the site characterization activities which may lead to release of radioactivity. Section 4 provides a description of the potential sources of radioactivity that site characterization could generate. Section 5 summarizes the sampling and monitoring methodology, which will be used to monitor the potential sources of radioactivity. The network of sampling and monitoring equipment is described in Section 6, and Section 7 summarizes the systems operation activities. The data reporting activities are described in Section 8. Finally, a description of the Quality Assurance (QA) and Quality Control (QC) activities is provided in Section 9. Appendix A contains a summary of the procedures to be used in this program, and Appendix B contains technical specification on equipment and services. 20 refs., 11 figs., 2 tabs.

10974 **(DOE/NV/10322—19) NNWSI [Nevada Nuclear Waste Storage Investigations] hole histories: USW G-1, USW G-2, USW G-3, USW G-4, USW GA-1, USW GU-3.** (Fenix and Scisson, Inc., Mercury, NV (USA)). Jun 1987. Contract AC08-84NV10322. 187p. NTIS, PC E17/MF $33.95; 1; GPO Dep. Order Number DE88004026/JAW.

This report is a compilation of data from six exploratory boreholes drilled to characterize the geologic, geophysical and hydrologic data for the Yucca Mountain block. The six boreholes were drilled adjacent to the Nevada Test Site (NTS). Information presented in this report include locations, daily activities, core records, mud records, reviews of hole condition, geophysical log listings, video tape listings, and microfiche copies of all geophysical logs run by the Fenix and Scisson, (F and S) subcontractors.

10975 **(DOE/WIPP—87-012) Quarter-scale modeling of room convergence effects on CH [contact-handled] TRU drum waste emplacements using WIPP [Waste Isolation Pilot Plant] reference design geometries.** VandeKraats, J. (I. T. Corp., Carlsbad, NM (USA)). Nov 1987. Contract AC04-86AL31950. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003764/JAW.

This study investigates the effect of horizontal room convergence on CH waste packages emplaced in the WIPP Reference Design geometry (rooms 13 feet high by 33 feet wide, with minus 3/8 inch screened backfill emplaced over and around the waste packages) as a function of time. Based on two tests, predictions were made with regard to full-scale 6-packs emplaced in the Reference Design geometry. These are that load will be transmitted completely through the stack within the first five years after waste emplacement and all drums in all 6-packs will be affected; that virtually all drums will show some deformation eight years after emplacement; that some drums may breach before the eighth year after emplacement has elapsed; and that based on criteria developed during testing, it is predicted that 1% of the drums emplaced will be breached after 8 years and, after 15 years, approximately 12% of the drums are predicted to be breached. 8 refs., 41 figs., 3 tabs.

10976 **(DP-MS—87-147) Applications of chemical engineering principles to glassmaking for nuclear waste fixation.** Boersma, M.D. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 14p. (CONF-880138—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88004274/JAW.

From Chemical engineering education in a changing environment conference; Santa Barbara, CA, USA (17 Jan 1988).

There are five important differences between radwaste vitrification and normal industrial glassmaking. The hostile (radioactive) environment requires the entire process to be operated and maintained remotely. This is largely a mechanical/architectural engineering problem because radiation has very little direct impact on process chemistry or energy. A second difference is that process plant economics are dominated by safety and reliability considerations, rather than market conditions and energy costs. Third, the product quality criteria are quite different; rather than optical clarity, mechanical strength, functional shape, and esthetic appeal, the important quality for radwaste glass is its chemical durability in final storage. Fourth, the off-gases from a radwaste vitrification process are of greater environmental concern. Equipment must be airtight or under vacuum, and highly efficient gas cleanup systems must be used. Finally, feed to a radwaste glass melter is typically at least 50% water. Liquid slurry melter feed is not unheard of in commercial glassmaking but dry batch feed is normal. Slurry water more than doubles the process energy demand in the melter and causes some very large local temperature gradients. 2 figs.

10977 **(DPST—85-862) New Low-Level Radioactive Waste Storage/Disposal Facilities at the Savannah River Plant: Environmental information document.** Cook, J.R.; Grant, M.W.; Towler, O.O. (Savannah River Lab., Aiken, SC (USA)). Apr 1987. Contract AC09-76SR00001. 530p. NTIS, PC A23/MF A01; 1; GPO Dep. Order Number DE88003932/JAW.

Site selection, alternative facilities, and alternative operations are described for a new low-level solid radioactive waste storage/disposal operation at the Savannah River Plant. Performance assessments and cost estimates for the alternatives are presented. Appendix G contains an intensive archaeological survey of alternative waste disposal areas in the Savannah River Plant area. 117 refs., 99 figs., 128 tabs.

10978 **(DPST—85-963) Transport of nitrate from a large cement-based wasteform.** Pepper, D.W. (Savannah River Lab., Aiken, SC (USA)). Oct 1986. Contract AC09-76SR00001. 23p. NTIS, PC A03/MF A01. Order Number DE88004271/JAW.

A two-dimensional finite element model has been developed to calculate the time-dependent transport of nitrate from a cement-based (saltstone) monolith. A steady-state velocity field is also calculated, based on saturated ground water flow and Darcy's law. Model predictions are compared with data from two lysimeter field experiments begun in 1984. The model results agree very well with data from the uncapped and clay-capped monoliths. A peak concentration of 140 ppM is predicted for the uncapped case within four years; the clay-capped case shows a rather flat peak of 70 ppM occurring within approximately 20 years. The clay cap effectively reduces the groundwater velocity and dispersion coefficient adjacent to the exposed monolith surface. The cap also significantly reduces the flux of nitrate out the top surface of the monolith, in contrast to the uncapped monolith. Predictions for a landfill monolith design show a peak concentration of approximately 280 ppM occurring within 25 years. Results indicate that the 44 ppM drinking water guideline would be exceeded for over 1000 years. Alternate designs and various restrictive liners are being considered. 9 refs., 8 figs.

10979 **(DPST—87-568) 1987 monitoring report for the defense waste lysimeters.** McIntyre, P.F. (Savannah River Lab., Aiken, SC (USA)). 10 Aug 1987. Contract AC09-76SR00001. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003315/JAW.

Low levels of radionuclides migrate through the soil to the sump. This report updates previous monitoring reports and discusses results obtained during the past year of operation. The effluents from the forty defense waste lysimeters continue to be analyzed on a monthly basis for gamma emitting radionuclides and quarterly for alpha emitting radionuclides and Sr-90. Cobalt-60, Sr-90, Sb-125, U-235, Pu-238, Pu-239 and Am-241 continue to be detected in sump effluent. Detectable levels of cobalt-60 and antimony-125 are each observed in only one lysimeter. Manganese-54, Ru-106 and Th-234 are no longer detected in effluent from any lysimeter. Significant levels of Sr-90 and Pu-238 are observed from several lysimeters, while others continue to show low levels of U-235, Pu-239 and Am-241. The release rates for transporting radionuclides through the soil to the sump indicate that migration is independent of whether a lysimeter is operated in a saturated or unsaturated mode. Pine trees continue to grow on the ten foot diameter lysimeters. No sampling of needles or woody stem portions was performed. The purpose of analyzing pine trees growing on lysimeters is to measure the amount of radionuclide uptake by the pine trees as their root systems come in contact with the waste material. 6 refs., 2 figs., 49 tabs.

10980 **(DPST—87-648) 1987 monitoring report of special wasteform lysimeters: Humid site.** McIntyre, P.F.; Hawkins, R.H. (Savannah River Lab., Aiken, SC (USA)). 17 Sep 1987. Contract AC09-76SR00001. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003316/JAW.

Analyses for radionuclides in the leachate from ten special wasteform lysimeters at the Savannah River Plant (SRP) have continued since January 1983. These included monthly analyses of lysimeter sump leachate for gamma-emitting radionuclides, and quarterly analyses of sump leachate for Sr-90 and of lysimeter soil moisture samples for gamma emitters. Cobalt-60 and Sr-90 continue to be the most abundant radionuclides detected in sump leachate from the lysimeters. Cesium-137 continues to occur regularly in the sump of one portland cement wasteform lysimeter, and sporadically in the sump of one other. Cesium-137 remains below detection limits at all of the polymer wasteform lysimeters, in both the monthly sump leachate and quarterly soil moisture samples. Results indicate that the polymer wasteforms retain Co-60 better by a factor of 100 than do the portland cement wasteforms. However, the portland wasteforms retain Sr-90 better by a factor of 10 than do the polymer wasteforms. No new radionuclides were detected at the lysimeters during the past year. 7 refs., 12 figs., 15 tabs.

10981 **(EGG—10282-2111) Nevada Nuclear Waste Storage Investigations: A review of requirements for biological information in federal, state, and local environmental laws and regulations.** Collins, E.; O'Farrell, T.P. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). Jan 1987. Contract AC08-83NV10282. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003669/JAW.

Biological information concerning Yucca Mountain collected since 1980 is evaluated to determine if it is sufficient to satisfy the requirements of the various federal, state, and local laws and regulations that pertain to environmental protection or to development of waste repositories. The pertinent requirements of each law are summarized, missing information is identified, and recommendations are made for studies to fill these gaps. 11 refs., 2 figs., 1 tab.

10982 **(ENEA-RT-COMB—85-4) Borosilicate glass for the Eurex high level wastes. Characterization and behaviour.** Donato, A.; J, Zhang; Gottardi, A.; Soraru, A. (ENEA, Casaccia, Italy. Centro Ricerche Energia; Padua Univ., Italy. Ist. di Chimica Industriale). (ENEA, Rome (Italy)). 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700982/JAW.

A borosilicate glass composition named BEL-15 has been studied for the solidification of the MTR high level wastes stored at the EUREX reprocessing plant. Its main physico-chemical characteristics have been reported, as well as the main results obtained in the characterization work. The glass mechanical strength has been determined according to two methods: the microindentation method and the impact test. The critical stress intensity factor Ksub(IC) is 0.93 +- 0.05 MPa.msup(1/2), while from the impact test a glass surface of 4.51 +- 0.89 cm*H2/J has been determined. During the glass leaching, performed according to the MCC-1 test using clay interstitial water as leachant, some crystal amounts seem to form over the glass surface, producing a sample weight increase after the test. The crystal nature has been investigated and some assumptions have been made.

10983 **(ENEA-RT-COMB—87-4) Performance study of DEXA densitometer for the assay of Uranium-Plutonium mixed solutions.** Aparo, M.; Dionisi, M.; Mattia, B.; Zeppa, P.; Angelini, P.; Baldini, E.; Sardo, I.; Frazzoli, F.V. (ENEA, Casaccia, Italy. Centro Ricerche Energia; Rome Univ., Italy). (ENEA, Rome (Italy)). 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88700984/JAW.

The present work has carried out in view of a possible installation of a densitometer, at EUREX reprocessing pilot plant, aimed to in-line control of the product stream,from the partial partition cycle, during the reprocessing campaign of TRINO CRUCIFORME spent fuels. Experimental results of a measurement campaign, carried out with DEXA densitometer at Plutonium Plant (ENEA-CRE CASACCIA), are reported. The instrument, which is based on the differential absorpiometry technique, allows simultaneous determination of two actinides in solution (acqueous or organic) through the transmission of fluorescence X-ray, induced on specific targets, by a primary gamma source.

10984 **(EPRI-NP—5497) Advanced radioactive waste assay methods: Final report.** Cline, J.E.; Robertson, D.E.; DeGroot, S.E. (Science Applications International Corp., Rockville, MD (USA); Pacific Northwest Lab., Richland, WA (USA); Stock Equipment Co., Cleveland, OH (USA)). Nov 1987. 281p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920097/JAW.

This report describes an evaluation of advanced methodologies for the radioassay of low power-plant low-level radioactive waste for compliance with the 10CFR61 classification rules. The project evaluated current assay practices in ten operating plants and identified areas where advanced methods would apply, studied two direct-assay methodologies, demonstrated these two techniques on radwaste in four operating plants and on irradiated components in two plants, and developed techniques for obtaining small representative aliquots from larger samples and for enhancing the ^{144}Ce activity analysis in samples of waste. The study demonstrated the accuracy, practicality, and ALARA aspects of advanced methods and indicates that cost savings, resulting from the accuracy improvement and reduction in sampling requirements can be significant. 24 refs., 60 figs., 67 tabs.

10985 **(EWE—2610.01) Identification of gaps in the national research effort related to radioactive waste management.** Thorne, M.C.; Plews, M.; Kane, P. (Electrowatt Engineering Services Ltd., Horsham (UK); Department of the Environment, London (UK)). Aug 1987. 78p. (DOE-RW—87.092). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88751830/JAW.

Based on papers submitted to the Government's Radioactivity Research and Environmental Monitoring Committee (RadREM), this report presents a consolidated summary of perceived research requirements for 1988/89 and a comparison with the research proposed for that period. On this basis, discussion is included of gaps in the national research effort to 1989, duplication of research plans and areas where better co-ordination or funding of research might be appropriate.

10986 **(FMPC—2101) Demonstration test operation of Feed Materials Production Center Biodenitrification Facility.** Benear, A.K.; Patton, J.B. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 1987. Contract AC05-86OR21600. 20p. (CONF-871075—28). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001734/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

A fluidized-bed biological denitrification (BDN) system was used to treat high-nitrate wastewater streams from a DOE owned uranium processing plant. A two-column system was used to demonstrate BDN operation on a production scale. In a continuous 200 hour rate determination period, the BDN processed over 1.6 million gallons that contained over 4700 kilograms of nitrate and nitrite nitrogen. The BDN removed an average 97% of the incoming nitrate and nitrite. The BDN effluent was discharged to the FMPC sewage treatment plant where it caused increased levels of TOD, TSS and fecal coliforms in the STP discharge. This indicated the BDN effluent will require treatment prior to discharge to the environment. Preliminary chemical consumption rates and associated costs of operation were determined. Several modifications and additions to the system were identified as necessary for the permanent production facility. 3 refs., 11 figs., 2 tabs.

10987 **(FMPC/Sub—008-Vol.2) Characterization investigation study: Volume 2, Chemical and radiological analysis of waste pits.** Solow, A.J.; Phoenix, D.R. (Weston (Roy F.), Inc., West Chester, PA (USA)). Nov 1987. Contract AC05-86OR21600. 422p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88003560/JAW.

The Feed Materials Production Center (FMPC) was constructed to produce high purity uranium metal for use at various Department of Energy facilities. The waste products from these operations include: general uncontaminated scrap and refuse, contaminated and uncontaminated metal scrap, waste oils, low-level radioactive waste, co-contaminated wastes, mixed waste, toxic waste, sludges from water treatment, and fly ash from the steam plant. This material has been stored in designated areas and is estimated to total more than 350,000 cubic meters. Most of the process waste is contained in pit nos. 1 through 6. Specific alternatives are being developed and evaluated for the final disposition of the waste inventory currently stored at the site. Selective investigations were conducted to characterize the material contained within the approximate 100-acre Waste Storage Area. This report presents the methodology used to sample and analyze the waste materials. A total of 790 samples was obtained for the various types of analyses. A portion of each sample was immediately sealed for volatile organic analysis for later compositing in the laboratory, a portion for gamma ray spectral analysis, and a composite made of samples from each borehole for nonvolatile chemical and radiochemical analysis. Chain-of-custody forms were completed for each sample. 12 refs., 10 figs., 37 tabs.

10988 **(INIS-mf—11094) Situation in Italy of radiactive wastes and spent fuels.** (ENEA, Rome (Italy)). 1986. 21p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701316/JAW.

After having done a classification of radioactive wastes, some principles of radioprotection referred to the management and disposal are established according to their nature. Methods and responsabilities for the management of wastes are reported together with a description of the present situation in Italy.Finally studies carried out and under way in this field are described.

10989 **(INIS-mf—11601) Investigations on the volatilisation of uranium fission products in the conditions of vitrification of high level waste.** Heitz, J. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Chemie, Biologie und Geowissenschaften). 15 May 1986. 264p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number TI88751926/JAW.

The vitrification process of HLW was simulated on the laboratory scale, where liquid and solid HLW concentrates in inactive form, with tracer additives of Te 99, Np 237, Pu 239, Am 241, Se 75, Nb 95 and Sb 124 were used. Separating elements for the released aerosols in the waste gas section of the vitrification apparatus were PTFE filters, a 10 stage cascade impactor with aluminium deposit foils and washing solutions. Technetium shows a synergistic effect on the reasonably volatile caesium, so that this is in the group of highly volatile elements: Se, Te, Ru, Tc, Cs and Rb. The effect of different parameters such as transport air speed, quantity used, dwell time, reduction of the experimental temperature, specificity for the element of the time course, element concentration in solid or liquid simulate, composition of the glass melt on the percentage throughput of the elements was examined. A careful analysis of the particles in the aerosol throughput, size, type and composition of particles was carried out.

10990 (IPEN-Pub—112, pp 22) **Development and design of a cementation process.** Vicente, R. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

The conceptual design of a facility for the immobilization of intermediate-level liquid wastes in cement is presented. The cementation process adopted a vibration assisted mixing process. The solidified waste is packed in 200 litres drum with barite concrete lining. The waste package is classified as Type A package for transport.

10991 (IPEN-Pub—112, pp 37) **Facility for low-level solid waste treatment.** Vicente, R.; Miyamoto, H. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

A facility for low-level solid waste compaction, encapsulation and storage is described. Solid wastes are compacted in 200 l drums and stored over concrete platforms covered with canvas, for

decay or for interim storage before transport to the final disposal site.

10992 (IPEN-Pub—112, pp 61) **Bituminization of simulated waste, spent resins, evaporator concentrates and animal ashes by extrusion process.** Grosche Filho, C.E.; Chandra, U. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

The results of the study of bituminization of simulated radwaste - spennt ion-exchange resins, borate evaporator/concentrates and animal ashes, are presented and discussed. Distilled and oxidizer bitumen were used. Characterization of the crude material and simulated wastes-bitumen mixtures of varying weigt composition (30, 40, 50, 60% by weight of dry waste material) was carried out. The asphaltene and parafin contents in the bitumens were also determined. Some additives and were used with an aim to improve the characteristcs of solidified wastes. For leaching studies, granular ion-exchange resins were with Cs - 134 and mixtures of resin-bitumen were prepared. The leaching studies were executed using the IAEA recommendation and the ISO method. A conventional screw-extruder, common in plastic industry, was used determine operational parameters and process difficulties. Mixtures of resin-bitumen and evaporator concentrate-bitumen obtained from differents operational conditions were characterized.

10993 (IPEN-Pub—112, pp 70) **Design of an evaporator/crystallizer for radioactive liquid waste treatment.** Grosche Filho, C.E.; Dellamano, J.C.; Dalaqua Junior, L. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

This paper describes a design an evaporation/crystalization unit for liquid waste treatment. The project is intended to waste treatment of the I-131 production plant. The waste composition is: Te isotopos, $MoO^{3-}{}_4$ ions and I-131 residual in 5M H_2SO_4 solution. At present the waste is stored to allow complete decay; but the risk of accident in handling, transport and storing associated to the space necessary to this, justify the study. This project was developed in parallel with the study of chemical treatment techniques that search for a more secure storage form. The design of the unit was made in a versatile form to be applied not only to this waste but also to other types of liquid wastes existing at IPEN-CNEN/SP. One evaporator/crystallizer unit with 7 l/h capacity was designed as a two body unit with two external heating system. Special attention was given to the system of collecting the solid product. It was designed to act as a container of the solid waste. In addition it avoid the contact of waste with cement or other package used. This part of the evaporator/crystallizer unit is attached by a locked pneumatic system that guarantees the unit to be watertight. When necessary, the design foresee the substitution of this part by a fixed valve to collect concentrated products. Considerations about waste composition, waste collection, materials and process security necessary to establish a reliable project are made. The flow-sheet process and drawings of the evaporator/crystallizer unit are also presented.

10994 (IPEN-Pub—112, pp 76) **Incineration facility for combustible solid and liquid radioactive wastes in IPEN-CNEN - Sao Paulo.** Krutman, I.; Grosche Filho, C.E.; Chandra, U.; Suarez, A.A. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

A system for incinerating the combustible solid and liquid radioactive wastes was developed in order to achieve higher mass and volume reduction of the wastes generated at IPEN-CNEN/SP or received from other institutions. The radioactive wastes for incineration are: animal carcasses, ion-exchange resins, contaminated lubricant oils, cellulosic materials, plastics, etc. The optimization of the process was achieved by considering the following factors: selection of better construction and insulating material; dimensions; modular design of combustion chambers to increase burning capacity in future; applicability for various types of wastes; choise of gas cleaning system. The off-gas system utilizes dry treatment. The operation is designed to function with a negative pressure.

10995 (IPEN-Pub—112, pp 82) **Volume reduction and toluene recuperation from liquid scintillation waste.** Dellamano, J.C.; Dalaqua Junior, L.; Suarez, A.A. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

This paper describes the experimental work undertaken to evaluate the recuperation of the liquid scintillator by NaOH treatment and also a distillation process to recovery only the toluene. Recovered toluene was compared with scintillation grade toluene in terms of efficiency and background counts the IPEN - CNEN/SP laboratories as well in a radioimmunoassay laboratory. Both of them certified the quality, of the recovered toluene for radioimmunoassay. The volume reduction attained decreases significantly the costs of treatment for the remaing wastes beyond the profit of the toluene recovered. All procedures including equipment drawing and results are reported.

10996 (IPEN-Pub—112, pp 120) **Experience on the operation of a low - level solid waste treatment facility.** Miyamoto, H.; Suarez, A.A.; Vicente, R. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

In the middle of 1982 a low-level solid waste compaction facility was commissioned to run cold tests aiming at licencing the facility to handle radioactive wastes. IN August 1983 begun normal operation and wastes arising from IPEN and many other institutions have been treated and packed successfully since then. The modifications on the original installation aiming at improving the performance of the facility are described. These include modifications on the baling press shaft, exchange of the original epoxi-based paint in the floor of the building, modification on the original concept for the storage site, and others. The procedures for the waste management and the associated radiological safety procedures are detailed. Up to now, despite some incidents, no contamination of personnel have been occurred.

10997 (IPEN-Pub—112, pp 1) **Design of a package for encapsulation, transport and final disposal of discarded radium needles.** Villalobos, J.P.; Vicente, R.; Suarez, A.A. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

This paper describes the development work aiming at designing and building a package for radium needles. These needles comes mainly from hospitals where they were used in radiotherapy, but industrial sources may be stored in this package. It was previously defined that the package should be in a form which is acceptable in final disposal site, and also conform the type A - non-special form, of the Regulations for the safe transport of radioactive materials, safety series n. 6, 1985 Edition, published by the IAEA. As the final disposal site has not yet been defined, there is not a list of requirements to be fulfilled by the package. Hence the adopted criterion was to keep the source in a non readily dispersible form. The development work was undertaken to select packaging materials as shieldings, structural and absorbing materials, to define package geometries and encapsulation process. As this waste will be temporally stored before transport to the final disposal site additional requirement was considered: radon leakage from the package should be limited. To find out a figure for the maximum leakage rate, an interim storage scenario was defined. The incurred doses on operating personnel from the radon leakage shpould not exceed maximun permissible doses for workers. The package has an inner stainless steel cilindrical capsule, with two cubic decimeter in volume, in

which the radium needles are enclosed with charcoal as an inert absorbing material. The shielding materials are a 0.5 cm thick lead layer inside a concrete shell 23 cm thick. The outer package is a 200 liters drum. Pertinent type A package tests were performed. This include integrity of containment system and shielding.

10998 **(IPEN-Pub—112, pp 6) Design and development of a liquid waste storage tank.** Vicente, R. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

The paper presented the work undertaken to develop the concept of an intermediate-level waste storage tank and and the laboratory work aiming at knowing and improving the performance of the associated instrumentation. Results of tested liquid agitator, liquid level indication and alarm devices are presented.

10999 **(JAERI-M—87-131) Progress report on safety research of high-level waste management for the period April 1986 to March 1987.** Nakamura, Haruto; Tashiro, Shingo (eds.). (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 94p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751451/JAW.

Researches on high-level waste management at the High Level Waste Management Laboratory and the Waste Safety Testing Facility Operation Division of the Japan Atomic Energy Research Institute in the fiscal year of 1986 are reviewed in the report. Topics in the three sections are as follows: 1) Non-radioactive research has been continued on Synroc irradiation and modellings of waste form leaching. 2) Research results are described in the section of Safety Evaluation for Geological Disposal on engineered barriers, field tests, safety assessment models, migration, natural analogue, seabed disposal and conceptual design of a repository. 3) Adsorption behaviour of plutonium on leach-containers and migration of leached cesium in a rock column are described in the section of Safety Examination of Vitrified Forms in the Hot Cells of WASTEF.

11000 **(LA—10532-MS) Two-dimensional numerical simulation of geochemical transport in Yucca Mountain.** Travis, B.J.; Nuttall, H.E. (Los Alamos National Lab., NM (USA)). Dec 1987. Contract W-7405-ENG-36. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004435/JAW.

Several physical and chemical processes can affect transport of radionuclides in Yucca Mountain. Geometric spreading and lateral flow will reduce the concentration of contaminated water reaching the accessible environment. Travel times to the water table are calculated to be at least several tens of thousands of years. Colloid transport can also enhance radionuclide transport, but will be important only if fracture flow is. Finally, the heat load from repository waste can alter the distribution of some naturally occurring minerals. In particular, dissolution and precipitation of SiO_2 should lead to a region of reduced permeability around waste canisters. 22 refs., 47 figs., 7 tabs.

11001 **(LA-UR—87-3854) Preliminary geochemical/geophysical model of Yucca Mountain.** Greenwade, L.E.; Cederberg, G.A. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 14p. (CONF-8711100—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003165/JAW.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (30 Nov 1987).

A comprehensive geochemical/geophysical model incorporates the current and relevant stratigraphic, petrologic, hydrogeologic, geochemical, and material data associated with a candidate repository at Yucca Mountain, Nevada. A geochemical/geophysical model will provide support and confidence to the Systems Performance calculations, determine whether the data collected as part of the site characterization provide the information needed by the design and performance assessment task, and provide the most accurate and referenced foundation on which to base the radionuclide transport calculations. In this report, the known repository data are compiled and unknown parameter values are estimated based on the available data. It is concluded that more data are needed before the geochemical/geophysical model of Yucca Mountain can be regarded as satisfactory and suitable base for multidimensional predicative flow and transport simulations. Recommendations for future studies concerning site characterization and data acquisition are presented. 36 refs., 1 fig., 2 tabs.

11002 **(NUREG/CR—4766) User's manual for the NEFTRAN computer code.** Longsine, D.E.; Bonano, E.J.; Harlan, C.P. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1987. Contract AC04-76DP00789. 161p. (SAND—86-2405). NTIS, PC E08/MF A01 - GPO. Order Number TI88002758/JAW.

Includes 1 sheet of 24x reduction microfiche.

This document describes the NEFTRAN (NEtwork Flow and TRANsport) computer code and provides the reader with enough detailed information to use the code. NEFTRAN was developed for the assessment of ground-water flow and radionuclide transport in high-level radioactive waste repositories mined in deep saturated and fractured geologic formations. NEFTRAN is a successor to NWFT/DVM and contains several new capabilities. These are generalized flow network, matrix diffusion, leg transfer, mixing cell, and multiple chains. This document's four main sections describe the mathematical representation of ground-water flow, radionuclide transport, matrix diffusion, source term, and leg-transfer models; the program and subprograms in the code; the input to the code; and sample problems highlighting each of the new capabilities of the code. 18 refs., 22 figs., 9 tabs.

11003 **(NUREG/CR—5040) Radionuclide migration around uranium ore bodies: Analogue of radioactive waste repositories: Annual report for 1984-1985.** Airey, P.L.; Duerden, P.; Roman, D.; Golian, C.; Nightingale, T.; Payne, T.; Davey, B.G.; Gray, D.; Fabryka-Martin, J.; Curtis, D.B. (Australian Atomic Energy Commission, Lucas Heights. Lucas Heights Research Labs.). Nov 1987. 217p. (AAEC/C—55). NTIS, PC A10/MF A01 - GPO. Order Number TI88900150/JAW.

Evaluation of the uranium ore bodies in the Northern Territory of Australia as natural analogues of high-level waste repositories is continuing. The study contributes to the scientific basis for the long-term prediction of radionuclide migration, assesses the assumptions underlying geochemical transport codes, and identifies those processes that are significant for long-term prediction, but are not observed over laboratory timescales. An open system model has been used to calculate the rate of redistribution of uranium within the secondary mineralization, and radionuclide transport equations have been used to calculate retarded uranium travel times in the Koongarra ore body. A wide range of techniques such as high gradient magnetic separation and sequential extraction procedures were used to study drill core and soil samples; other techniques such as fission and alpha recoil track analysis, proton induced x-ray and gamma-ray emission and electron microprobe analysis have been used to examine thin sections of the drill core. Supplies of drill core and groundwater colloids were collected in the field for ^{129}I and ^{239}Pu analyses and a comprehensive model for the production of ^{129}I in the uranium ore body was developed. Chapters 3, 5, 7, 8, 9 and 10 are processed separately for the data base. 117 refs., 54 figs., 41 tabs.

11004 **(NUREG/CR—5041-Vol.1) Recommendations to the NRC for review criteria for alternative methods of low-level radioactive waste disposal: Task 2a, Below-ground vaults.** Denson, R.H.; Bennett, R.D.; Wamsley, R.M.; Bean, D.L.; Ainsworth, D.L. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Dec 1987. 159p. NTIS, PC A08/MF A01 - GPO. Order Number TI88900263/JAW.

The US Army Engineer Waterways Experiment Station (WES) and the US Army Engineer Division, Huntsville (HNDED) have developed general design criteria and specific design review criteria for the below-ground vault (BGV) alternative method of low-level radioactive waste (LLW) disposal. A BGV is a reinforced concrete vault (floor, walls, and roof) placed underground below the frost line, and above the water table, surrounded by filter blanket and drainage zones and covered with a low permeability

earth layer and top soil with vegetation. Eight major review criteria categories have been developed ranging from the loads imposed on the BGV structure through material quality and durability considerations. Specific design review criteria have been developed in detail for seven of the eight major categories. 59 refs., 14 figs., 2 tabs.

11005 **(ORNL/EIS—154-Vol.8) Nuclear facility decommissioning and site remedial actions: A selected bibliography: Volume 8.** Owen, P.T.; Michelson, D.C.; Knox, N.P. (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 406p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88003753/JAW.

The 553 abstracted references on nuclear facility decommissioning, uranium mill tailings management, and site remedial actions constitute the eighth in a series of reports. Foreign and domestic literature of all types - technical reports, progress reports, journal articles, symposia proceedings, theses, books, patents, legislation, and research project descriptions - has been included. The bibliography contains scientific, technical, economic, regulatory, and legal information pertinent to the US Department of energy's remedial action program. Major chapters are Surplus Facilities Management Program, Nuclear Facilities Decommissioning, Formerly Utilized Sites Remedial Action Program, Facilities Contaminated with Naturally Occurring Radionuclides, Uranium Mill Tailings Remedial Action Program, Uranium Mill Tailings Management, Technical Measurements Center, and General Remedial Action Program Studies. Chapter sections for chapters 1, 2, 5, and 6 include Design, Planning, and Regulations; Environmental Studies and Site Surveys; Health, Safety, and Biomedical Studies; Decontamination Studies; Dismantlement and Demolition; Site Stabilization and Reclamation; Waste Disposal; Remedial Action Experience; and General Studies. Within these categories, references are arranged alphabetically by first author. Those references having no individual author are listed by corporate affiliation or by publication description. Indexes are provided for author, corporate affiliation, title word, publication description, geographic location, and keywords. The appendix contains a list of frequently used acronyms and abbreviations.

11006 **(ORNL/TM—10462) In situ grouting of a low-level radioactive waste trench.** Spence, R.D.; Godsey, T.T.; McDaniel, E.W. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003656/JAW.

A shallow land burial trench containing low level radioactive waste was injected with a particulate grout to help control subsidence and radionuclide migration. The trench's accessible voids have been estimated at 20 vol %, and most of these voids appear to have been filled with grout. This injection was accomplished with a simple, labor intensive technique, and an inexperienced crew at an estimated cost of about $55,000. The grout costs $0.21/gal and 8081 gal was injected into the trench. 5 refs., 10 figs., 4 tabs.

11007 **(ORNL/TM—10476/V1) Military construction program economic analysis manual: Text and appendixes: Hazardous Waste Remedial Actions Program.** (URS Corp., Santa Barbara, CA (USA); Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 124p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003755/JAW.

This manual enables the US Air Force to comprehensively and systematically analyze alternative approaches to meeting its military construction requirements. The manual includes step-by-step procedures for completing economic analyses for military construction projects, beginning with determining if an analysis is necessary. Instructions and a checklist of the tasks involved for each step are provided; and examples of calculations and illustrations of completed forms are included. The manual explains the major tasks of an economic analysis, including identifying the problem, selecting realistic alternatives for solving it, formulating appropriate assumptions, determining the costs and benefits of the alternatives, comparing the alternatives, testing the sensitivity of major uncertainties, and ranking the alternatives. Appendixes are included that contain data, indexes, and worksheets to aid in performing the economic analyses. For reference, Volume 2 contains sample economic analyses that illustrate how each form is filled out and that include a complete example of the documentation required. 6 figs., 12 tabs.

11008 **(ORNL/TM—10476/V2) Military construction program economic analysis manual: Sample economic analyses: Hazardous Waste Remedial Actions Program.** (URS Corp., Santa Barbara, CA (USA); Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 250p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88003772/JAW.

This manual enables the US Air Force to comprehensively and systematically analyze alternative approaches to meeting its military construction requirements. The manual includes step-by-step procedures for completing economic analyses for military construction projects, beginning with determining if an analysis is necessary. Instructions and a checklist of the tasks involved for each step are provided; and examples of calculations and illustrations of completed forms are included. The manual explains the major tasks of an economic analysis, including identifying the problem, selecting realistic alternatives for solving it, formulating appropriate assumptions, determining the costs and benefits of the alternatives, comparing the alternatives, testing the sensitivity of major uncertainties, and ranking the alternatives. Appendixes are included that contain data, indexes, and worksheets to aid in performing the economic analyses. For reference, Volume 2 contains sample economic analyses that illustrate how each form is filled out and that include a complete example of the documentation required.

11009 **(ORNL/TM—10638) Recovery, concentration, and solidification of europium by ion exchange from a dilute process stream.** Campbell, D.O. (Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004771/JAW.

A promising process to recover americium from a very dilute waste solution and convert it to a stable solid suitable for waste disposal is to load the americium onto organic ion-exchange resins and burn the resins to yield a granular solid that can be disposed of directly or formed into a monolith using known solidification processes. Experiments were carried out in which europium, a stand-in for americium, was loaded onto small ion exchange resin columns from dilute aqueous solutions containing nitric acid and, in some cases, iron. The effluent solution was decontaminated sufficiently to be a non-TRU waste in the plant application. The volumetric distribution coefficient under anticipated conditions was in the range of 18,000, indicating that a relatively very small volume of solid, americium-loaded, ion-exchange resin would be produced. Burning the loaded resin in air yields a stable, solid oxysulfate with a further volume reduction of about a factor of six. Iron, and possibly other impurities, can interfere with the americium recovery. 8 refs., 7 figs., 2 tabs.

11010 **(PB—88-106869/XAB) Recovery of low-level radioactive waste packages from deep ocean disposal sites. Technical report.** Walden, B.B. (Woods Hole Oceanographic Institution, MA (USA). Dept. of Ocean Engineering). Mar 1987. 43p. (WHOI—87-14). NTIS, PC A03/MF A01.

This paper presents the methods used for the recovery of three low-level radioactive-waste packages from deep-ocean disposal sites in the Atlantic and Pacific Oceans. The design of the recovery equipment and its utilization by the submersibles ALVIN and PISCES VI is described. Considerations for future waste disposal and recovery techniques are provided.

11011 **(PB—88-111414/XAB) REPRISK code documentation. Volume 1. Final report.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). 1 Oct 1983. 242p. NTIS, PC A11/MF A01.

To assist the Environmental Protection Agency in evaluating releases from a variety of combinations of geologic settings, radionuclide inventories, mechanisms, and pathways for radioactive releases, time frames, and dose-uptake pathways, a computer model based on the results of these technical investigations was developed. The model is called REPRISK. The report is documentation for

the REPRISK code. It concentrates on the mechanics of the model.

11012 **(PNL—6297) Model assessment of protective barrier designs: Part 2.** Fayer, M.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003721/JAW.

Protective barriers are being considered for use at the Hanford Site to enhance the isolation of radioactive wastes from water, plant, and animal intrusion. This study assesses the effectiveness of protective barriers for isolation of wastes from water. In this report, barrier designs are reviewed and several barrier modeling assumptions are tested. 20 refs., 16 figs., 6 tabs.

11013 **(PNL—6314) Protective barrier materials analysis: Fine soil site characterization: A research report for Westinghouse Hanford Company.** Last, G.V.; Glennon, M.A.; Young, M.A.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003442/JAW.

We collected soil samples for the physical characterization of a potential fine-soil quarry site at the McGee Ranch, which is located approximately 1 km northwest of the Hanford Site's Yakima Barricade. Forty test borings were made using a hollow-stem auger. Field moisture content and grain-size distribution were determined. The samples were classified into one of 19 sediment classes based on their grain-size distributions. Maps and cross sections were constructed from both the field and laboratory data to delineate the distributions of the various sediment classes. Statistical evaluations were made to determine the variations within the fine-soil fraction of the various sediment classes. Volume estimates were then made of the amounts of soil meeting the preliminary grain-size criteria. The physical characterization of the fine soils sampled near the McGee Ranch site indicated that approximately 3.4 million cubic meters of soil met or exceeded the minimum grain-size criteria for the fine soils needed for the protective barriers program. 11 refs., 14 figs., 6 tabs.

11014 **(PNL—6320-1) LFCM [liquid-fed ceramic melter] vitrification technology: Quarterly progress report, October-December 1986.** Brouns, R.A.; Allen, C.R.; Powell, J.A. (comps.). (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 90p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE88003441/JAW.

This report describes the progress in developing, testing, applying, and documenting liquid-fed ceramic melter (LFCM) vitrification technology. Progress in the following technical subject areas during the first quarter of FY 1987 is discussed. Topics include melting process chemistry and glass development, feed preparation and transfer systems, melter systems, off-gas systems, canister filling and handling systems, and process/product modeling.

11015 **(PNL—6325) Nuclear Waste Treatment Program: Annual report for FY 1986.** Burkholder, H.C.; Brouns, R.A. (comps.); Powell, J.A. (ed.). (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 223p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88004243/JAW.

To support DOE's attainment of its goals, Nuclear Waste Treatment Program (NWTP) is to provide technology necessary for the design and operation of nuclear waste treatment facilities by commercial enterprises as part of a licensed waste management system and problem-specific treatment approaches, waste form and treatment process adaptations, equipment designs, and trouble-shooting. This annual report describes progress during FY 1986 toward meeting these two objectives. 29 refs., 59 figs., 25 tabs.

11016 **(SAND—84-1895) Technical basis for performance goals, design requirements, and material recommendations for the NNWSI [Nevada Nuclear Waste Storage Investigations] Repository Sealing Program.** Fernandez, J.A.; Kelsall, P.C.; Case, J.B.; Meyer, D. (Sandia National Labs., Albuquerque, NM (USA); IT Corp., Albuquerque, NM (USA)). Sep 1987. Contract AC04-76DP00789. 355p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE88003269/JAW.

The objectives are to develop performance goals, to assess the need for seals, to define design requirements, and to recommend potential sealing materials for the sealing system. Performance goals are the allowable amounts of water that can enter the waste disposal areas directly from the rock mass above the repository and indirectly from shafts and ramps connecting to the underground facility. These goals are developed using a numerical model that calculates radionuclide releases. To determine the need for sealing, estimates of water flow into shafts, ramps, and the underground facility under anticipated conditions are developed and are compared with the performance goals. It is concluded that limited sealing measures, such as emplacement of shaft fill, are sufficient to properly isolate the radioactive waste in the repository. A broad range of sealing design options and associated hydrologic design requirements are proposed to provide a greater degree of assurance that the hydrologic performance goals can be met even if unanticipated hydrologic flows enter the waste disposal areas. The hydrologic design requirements are specific, hydraulic conductivity values selected for specific, seal design options to achieve the performance goals. Using these hydrologic design requirements and additional design requirements, preferred materials are identified for continued design and laboratory analyses. In arriving at these preferred materials, results from previous laboratory testing are briefly discussed. 96 refs., 48 figs., 28 tabs.

11017 **(SAND—84-2641-Vol.3) Site characterization plan: Conceptual design report, Volume 3: Appendices A-E: Nevada Nuclear Waste Storage Investigations Project.** MacDougall, H.R.; Scully, L.W.; Tillerson, J.R. (comps.). (Sandia National Labs., Albuquerque, NM (USA); Bechtel National, Inc., San Francisco, CA (USA); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (USA)). Sep 1987. Contract AC04-76DP00789. 553p. NTIS, PC A24. Order Number DE88004779/JAW.

This document presents a description of a prospective geologic repository for high-level radioactive waste to support the development of the Site Characterization Plan for the Yucca Mountain site. The site for the prospective repository is located at Yucca Mountain in southwestern Nevada, and the waste emplacement area will be constructed in the underlying volcanic tuffs. The target horizon for waste emplacement is a sloping bed of densely welded tuff more than 650 ft below the surface and typically more than 600 ft above the water table. The conceptual design described in this report is unique among repository designs in that it uses ramps in addition to shafts to gain access to the underground facility, the emplacement horizon is located above the water table, and it is possible that 300- to 400-ft-long horizontal waste emplacement boreholes will be used. This report summarizes the design bases, design and performance criteria, and the design analyses performed. The current status of meeting the preclosure performance objectives for licensing and of resolving the repository design and preclosure issues is presented. Volume 3 contains Appendices A through E.

11018 **(SAND—84-2641-Vol.4) Site characterization plan: Conceptual design report: Volume 4, Appendices F-O: Nevada Nuclear Waste Storage Investigations Project.** MacDougall, H.R.; Scully, L.W.; Tillerson, J.R. (comps.). (Sandia National Labs., Albuquerque, NM (USA); Bechtel National, Inc., San Francisco, CA (USA); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (USA)). Sep 1987. Contract AC04-76DP00789. 817p. NTIS, PC A99. Order Number DE88004780/JAW.

The site for the prospective repository is located at Yucca Mountain in southwestern Nevada, and the waste emplacement area will be constructed in the underlying volcanic tuffs. The target horizon for waste emplacement is a sloping bed of densely welded tuff more than 650 ft below the surface and typically more than 600 ft

above the water table. The conceptual design described in this report is unique among repository designs in that it uses ramps in addition to shafts to gain access to the underground facility, the emplacement horizon is located above the water table, and it is possible that 300- to 400-ft-long horizontal waste emplacement boreholes will be used. This report summarizes the design bases, design and performance criteria, and the design analyses performed. The current status of meeting the preclosure performance objectives for licensing and of resolving the repository design and preclosure issues is presented. The repository design presented in this report will be expanded and refined during the advanced conceptual design, the license application design, and the final procurement and construction design phases. Volume 4 contains Appendices F to O.

11019 **(SAND—84-2641-Vol.6) Site characterization plan: Conceptual design report: Volume 6, Drawing portfolio: Nevada Nuclear Waste Storage Investigations Project.** MacDougall, H.R.; Scully, L.W.; Tillerson, J.R. (comps.). (Sandia National Labs., Albuquerque, NM (USA); Bechtel National, Inc., San Francisco, CA (USA); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (USA)). Sep 1987. Contract AC04-76DP00789. 247p. NTIS, PC A11. Order Number DE88004782/JAW.

This document presents a description of a prospective geologic repository for high-level radioactive waste to support the development of the Site Characterization Plan for the Yucca Mountain site. The site for the prospective repository is located at Yucca Mountain in southwestern Nevada, and the waste emplacement area will be constructed in the underlying volcanic tuffs. The target horizon for waste emplacement is a sloping bed of densely welded tuff more than 650 ft below the surface and typically more than 600 ft above the water table. The conceptual design described in this report is unique among repository designs in that it uses ramps in addition to shafts to gain access to the underground facility, the emplacement horizon is located above the water table, and it is possible that 300- to 400-ft-long horizontal waste emplacement boreholes will be used. This report summarizes the design bases, design and performance criteria, and the design analyses performed. The current status of meeting the preclosure performance objectives for licensing and of resolving the repository design and preclosure issues is presented. The repository design presented in this report will be expanded and refined during the advanced conceptual design, the license application design, and the final procurement and construction design phases. Volume 6 contains drawings. 114 figs.

11020 **(SAND—85-7117) A first survey of disruption scenarios for a high-level-waste repository at Yucca Mountain, Nevada: Nevada Nuclear Waste Storage Investigations Project.** Ross, B. (Disposal Safety, Inc., Washington, DC (USA)). Dec 1987. Contract AC04-76DP00789. 147p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88004144/JAW.

A high-level-waste repository located in unsaturated welded tuff at Yucca Mountain, Nevada, would rely on six different, although not entirely independent, barriers to prevent escape of radioactivity. These barriers are the waste canister, fuel cladding, dissolution of the spent fuel itself, and movement of released contaminants in the unsaturated Topopah Spring welded tuff unit, the unsaturated Calico Hills nonwelded tuff unit, and the saturated tuff aquifer. Fifty-eight processes and events that might affect such a repository were examined. Eighty-four different sequences were identified by which these processes and events could lead to failure of one or more barriers. Sequences that had similar consequences were grouped into 17 categories: direct release, repository flooding, colloid formation, increased water flux through the repository, accelerated fracture flow, water diverted toward the waste package, accelerated dissolution mechanisms, accelerated cladding corrosion mechanisms, accelerated canister corrosion mechanisms, canister breakage, fracture flow in the Topopah Spring welded unit without increased moisture flux, reduced sorption in the Topopah Spring welded unit, water table rise above the Calico Hills nonwelded unit, fracture flow in the Calico Hills nonwelded unit, new discharge points, and faster flow in the saturated zone. 52 refs., 6 figs., 1 tab.

11021 **(SAND—86-2157) Definitions of reference boundaries for the proposed geologic repository at Yucca Mountain, Nevada.** Rautman, C.A.; Whittet, B.C.; South, D.L. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004148/JAW.

Reference locations are proposed for six boundaries or regions specified by federal regulations related to a proposed high-level nuclear waste repository at Yucca Mountain in southern Nevada. These proposed boundaries establish the limits and extent of the underground facilities; the disturbed zone around those underground facilties; the geologic repository operations area, the restricted area for preclosure radiation protection, the controlled area, and the accessible environment. For each boundary, discussion of the underlying regulations is followed by a description of the proposed location of that boundary. A section describes the rationale for choosing that particular, site-specific location in relationship to the generic regulatory definition. 21 refs., 11 figs.

11022 **(SAND—86-2533) Meteorological tower data for the Yucca Alluvial (YA) site and Yucca Ridge (YR) site: Final data report, July 1983-October 1984.** Church, H.W.; Freeman, D.L.; Boro, K.; Egami, R.T. (Sandia National Labs., Albuquerque, NM (USA); Nevada Univ., Reno (USA). Desert Research Inst.). Nov 1987. Contract AC04-76DP00789. 63p. NTIS, PC E05/MF A01; 1; GPO Dep. Order Number DE88004638/JAW.

The purpose of the NNWSI meteorological data collection program was to support environmental evaluations of site suitability for a nuclear waste repository. This is the last of a series of data summaries for the NNWSI Alluvial and Ridge Sites in southern Nevada. 3 refs., 3 figs., 6 tabs.

11023 **(SAND—86-7004) Design of a machine to bore and line a long horizontal hole in tuff: Nevada Nuclear Waste Storage Investigations Project.** Friant, J.E.; Dowden, P.B. (Robbins Co., Kent, WA (USA)). Sep 1987. Contract AC04-76DP00789. 146p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003618/JAW.

This report describes an engineering design for equipment capable of simultaneously drilling and lining deep horizontal bore holes. The ultimate use of the equipment is to bore up to 600 ft long, 3 ft diameter emplacement holes for a nuclear waste repository. The specific system designed is referred to as a Development Prototype Boring Machine (DPBM) which will be used to demonstrate the drilling/lining capability in field development tests. The system utilizes as in-hole electric drive and a vacuum chip removal and handling system. The drilling unit is capable of active directional control and uses laser-type alignment equipment. The system combines the features of a small steerable tunnel boring machine, combined with a horizontally-oriented raise drill, thereby utilizing current technology. All elements of the system are compact and mobile as required for a shaft entry, underground mining environment. 3 refs., 35 figs., 1 tab.

11024 **(SAND—86-7014C) Design methodology to develop a conceptual underground facility for the disposal of high-level nuclear waste at Yucca Mountain, Nevada.** Zerga, D.P.; Badie, A. (Parsons-Brinckerhoff, New York (USA)). 1986. Contract AC04-76DP00789. 13p. (CONF-8609177—1-Vugraphs). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002350/JAW.

From Structures congress '86: symposium on super and parallel computers and their impact on civil engineering; New Orleans, LA, USA (15 Sep 1986).

This paper examines the design methodology employed to develop conceptual underground layouts for a prospective high level nuclear waste repository at Yucca Mountain, Nevada. This study is in conjunction with the Nevada Nuclear Waste Storage Investigations (NNWSI), project studying the disposal of high level waste in densely welded tuff. The fundamental design effort concentraes on the effects of the heat released from the decaying waste forms and the impact of this heat on ventilation, waste emplacement configurations, and rock stability. This effort will perfect the design of the waste emplacement layout including emplacement

hole spacing, emplacement drift spacing, and the areal power density (APD) for the installed waste. This paper contains only viewgraphs. 11 figs.

11025 (SAND—87-1245) Repository waste-handling equipment development plan: Nevada Nuclear Waste Storage Investigations Project. Glowka, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003229/JAW.

This report presents a plan for developing equipment for emplacing and, if necessary, retrieving high-level nuclear waste at the proposed Yucca Mountain repository in Nevada. A 7-year development program is proposed, prior to repository license application. Costs and manpower requirements are estimated for each of 133 separate tasks and are integrated on a monthly, annual, and program-life basis. The program is structured to provide critical information needed to select a waste emplacement configuration, and the effects of the selection on subsequent equipment development and demonstration costs are estimated. The total program costs are estimated to be approximately $23.4 to 26.8 million if a vertical waste emplacement configuration is selected in FY 1990. If a horizontal waste emplacement configuration is selected at that time, total program costs would be appoximately $25.4 to 31.3 million. 15 refs., 18 figs., 5 tabs.

11026 (SAND—87-1274C) Brine transport studies in the bedded salt of the Waste Isolation Pilot Plant (WIPP). McTigue, D.F.; Nowak, E.J. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 10p. (CONF-871124—19). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003994/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Brine flow has been measured to unheated boreholes for periods of a few days and to heated holes for two years in the WIPP facility. It is suggested that Darcy flow may dominate the observed influx of brine. Exact solutions to a linearized model for one-dimensional, radial flow are evaluated for conditions approximating the field experiments. Flow rates of the correct order of magnitude are calculated for permeabilities in the range 10^{-21} to 10^{-20} m^2 (1 to 10 nanodarcy) for both the unheated and heated cases. 20 refs., 3 figs., 1 tab.

11027 (SAND—87-1476C) A robotic radiation survey and analysis system. Thunborg, S. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-871101—67). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002643/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

A robotic system used to conduct radiation surveys on a prototypical nuclear waste shipping cask is presented. The system integrates sensing and computer based reasoning into the control of a commercial gantry robot. This allows location of the cask, automatic development of radiation survey test plans, and execution of complete radiation surveys including force controlled contact swiping at random locations on the cask surface. The robotic system incorporates data management and real-time graphical presentation of survey results. 8 refs., 8 figs.

11028 (SAND—87-2125) Results of an international parallel calculations exercise comparing creep responses predicted with three computer codes for two excavations in rock salt. Morgan, H.S.; Wallner, M.; Munson, D.E. (Sandia National Labs., Albuquerque, NM (USA); Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)). Nov 1987. Contract AC04-76DP00789. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003439/JAW.

Creep responses computed with the ANSALT finite element code, which was developed by the Federal Institute for Geosciences and Natural Resources in the Federal Republic of Germany (FRG), are compared to responses computed in the United States with the SANCHO and SPECTROM codes for two well defined boundary value problems. One boundary value problem is an idealization of an underground room configuration proposed as a repository for low level nuclear waste. The other is an idealization of a room configuration designed for testing the effect of heat on the structural response of rock salt. Both room configurations represent actual excavations in bedded salt at the Waste Isolation Pilot Plant facility near Carlsbad, New Mexico. The SANCHO and SPECTROM solutions to the boundary value problems have already been compared and analyzed extensively in an earlier parallel calculations exercise. The study presented here is an extension of the earlier exercise and was performed as part of a bilateral agreement between the US and the FRG to exchange technology related to the development of nuclear waste repositories in rock salt. Parameters on which the comparisons are based include both displacements and stresses. A rigorous set of procedures designed to eliminate input errors was followed. The comparisons indicate only minor differences between the ANSALT, SANCHO, and SPECTROM solutions, and in most cases reasons for these differences are clearly identified. 14 refs., 62 figs., 2 tabs.

11029 (SAND—87-2203) Development, implementation and early results: Test Series C of the small-scale seal performance tests. Stormont, J.C.; Howard, C.L. (Sandia National Labs., Albuquerque, NM (USA); RE/SPEC, Inc., Albuquerque, NM (USA)). Dec 1987. Contract AC04-76DP00789. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004633/JAW.

This report provides information about the development and implementation of this test including a description of the machine used to press the blocks; results from a limited study to optimize the blocks; estimates of block properties; description of instrumentation used in Test Series C to measure pressure and displacement; seal emplacement methods; and "as-built" hole, seal and instrumentation configurations. Deformation and pressure data through about 160 days after seal emplacement are given. Preliminary fluid flow results indicate the salt/bentonite block-type seals may be effective barriers to flow shortly after installation. 21 refs., 34 figs., 6 tabs.

11030 (SAND—87-7039) Thermal and thermomechanical analyses of WIPP [Waste Isolation Pilot Plant] shaft seals: Topical report RSI-0324. Van Sambeek, L.L. (RE/SPEC, Inc., Rapid City, SD (USA)). Oct 1987. Contract AC04-76DP00789. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003614/JAW.

Thermal and thermomechanical analyses provided information on the behavior and stability of concrete seals emplaced in a circular shaft. The two types of concrete considered were an expansive salt-saturated concrete for seals located in rock salt or other rock and an expansive freshwater concrete for seals located in nonsalt rock. Thermal analyses determined the temperature rise in the concrete and surrounding rock as a result of the exothermic hydration of the cement in the concretes. The thermomechanical analyses considered time-dependent elastic modulus, thermoelastic expansion, time-dependent chemically induced expansion, and creep of the concrete; thermoelastic behavior of the nonsalt rocks; and thermoelastic and creep behavior of the rock salt. Supplementary analyses determined the effects of pressure loading on a face of the seal as might result from a static brine head or the swelling of a bentonite backfill; the influence of using a reduced elastic modulus for the rock salt; and the effect of eliminating the chemical expansivity of the concrete. Results of interest were the development of radial stress in the seal, the magnitudes of tensile and shear stresses induced in the seal and rock, and the effect of bonding or lack of bonding between the seal and the surrounding rock. The chemical expansivity of the concrete was shown to be important for the development of radial stresses in the seal and at the contact between the seal and the surrounding rock. The shear stresses induced in the seal by the swelling pressure of bentonite become a concern if the radial stresses are not developed. 20 refs., 58 figs., 3 tabs.

11031 **(SAND—87-7041) Fluid flow measurements of Test Series A and B for the Small Scale Seal Performance Tests.** Peterson, E.W.; Lagus, P.L.; Lie, K. (S-Cubed, La Jolla, CA (USA)). Dec 1987. Contract AC04-76DP00789. 141p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88004437/JAW.

The degree of waste isolation achieved by a repository seal system is dependent upon the fluid flow characteristics, or permeability, of the seals. In order to obtain meaningful, site-specific data on the performance of various possible seal system components, a series of in situ experiments called the Small Scale Seal Performance Tests (SSSPT) are being conducted at the Waste Isolation Pilot Plant (WIPP). This report contains the results of gas flow, tracer penetration, and brine flow tests conducted on concrete seals in vertical (Test Series A) and horizontal (Test Series B) configurations. The test objectives were to evaluate the seal performance and to determine if there existed scaling effects which could influence future SSSPT designs. 3 refs., 77 figs.

11032 **(SAND—87-7105) Regional double-porosity solute transport in the Culebra dolomite: An analysis of parameter sensitivity and importance at the Waste Isolation Pilot Plant (WIPP) site.** Reeves, M.; Kelley, V.A.; Pickens, J.F. (Intera Technologies, Inc., Austin, TX (USA)). 24 Nov 1987. Contract AC04-76DP00789. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88004730/JAW.

A high-transmissivity fracture-controlled path is assumed, for modeling purposes, to provide the means for transport of infinitely long-lived radionuclides through the Culebra dolomite to the accessible environment at the Waste Isolation Pilot Plant (WIPP) site, following a breach which does not disturb the existing head potentials within the unit. Both matrix diffusion and sorption retard the transport. Parameter ranges and base-case values depict the uncertain properties of the Culebra while simulations with SWIFT II exhibit the corresponding ranges in travel time, the performance measure adopted for this report. Consistent with the paucity of the double-porosity data base, model assumptions are kept simple and parameter ranges relatively large. Thus, computed travel times may be unrealistic and should not be quoted apart from the model assumptions. Computed parameter sensitivities and estimated parameter importance, however, should provide valuable guidance to the current site-characterization program at the WIPP site. The report demonstrates the importance of the rate of fluid flow within the fractures and the relative capacity of the rock matrix for the retention of radioactive contaminants. It also demonstrates the relative unimportance of some of the matrix kinetic parameters which relate to the matrix-diffusion time. 53 refs., 46 figs., 15 tabs.

11033 **(SAND—87-7125) WIPP Hydrology Program: Waste Isolation Pilot Plant, southeastern New Mexico, Hydrologic Data Report No. 5: Parts, A-WIPP-13 multipad test; B-H-4c, P-17, ERDA-9, and Cabin Baby-1 slug tests; C-Engle and Carper well pumping tests; D-WIPP-12, H-14, and H-15 drill-stem tests; E-Water-level data.** Stensrud, W.A.; Bame, M.A.; Lantz, K.D.; LaVenue, A.M.; Palmer, J.B.; Saulnier, G.J. Jr. (Intera Technologies, Inc., Austin, TX (USA)). 9 Oct 1987. Contract AC04-76DP00789. 635p. NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE88003613/JAW.

Part A of this report describes the objectives, scope, design, equipment, and methodology for a long-term pumping test conducted at the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The test was conducted to provide technical assistance as part of the ongoing hydrologic characterization of the WIPP site. The test is referred to as the northern multipad pumping test, because it was designed to create a hydraulic stress over a wide area of the northern half of the WIPP site. The fluid-pressure and water-level recovery in both pumping and observation wells were monitored for a minimum of 72 days. The test interval was the Culebra Dolomite Member of the Rustler Formation. Twenty-three observation wells completed in the Culebra dolomite were monitored at least once a month as part of the regional water-level monitoring program. Severl wells completed in the Magenta Dolomite Member of the Rustler Formation were monitored during the test to assess the possibility of Magenta-Culebra communication in the expected area of influence of this test. The succeeding sections of this part of Hydrologic Data Report No. 5 present detailed descriptions of the test objectives, pretest data collection, test equipment and test-well configuration, the observation-well network, and test results. 3 refs., 147 figs., 107 tabs.

11034 **(SAND—87-7149) User's manual for the UNDERDOG [Underground Nuclear Depository Evaluation, Reduction, and Detailed Output Generator] data reduction software.** Ball, J.R.; Shepard, L.K. (RE/SPEC, Inc., Albuquerque, NM (USA)). Dec 1987. Contract AC04-76DP00789. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88004632/JAW.

UNDERDOG is a computer program that aids experimentalists in the process of data reduction. This software allows a user to reduce, extract, and generate displays of data collected at the WIPP site. UNDERDOG contains three major functional components: a Data Reduction package, a Data Analysis interface, and a Publication-Quality Output generator. It also maintains audit trails of all actions performed for quality assurance purposes and provides mechanisms which control an individual's access to the data. UNDERDOG was designed to run on a Digital Equipment Corporation VAX computer using the VMS operating system. 8 refs., 24 figs., 2 tabs.

11035 **(SAND—87-7164) WIPP [Waste Isolation Pilot Plant] horizon free field fluid transport characteristics.** Peterson, E.W.; Lagus, P.L.; Lie, K. (S-Cubed, La Jolla, CA (USA)). Dec 1987. Contract AC04-76DP00789. 105p. (SSS-R—87-8844). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88004640/JAW.

This report describes the first attempt to measure the free field brine transport characteristics of the host rock. The data, which have been used to estimate the brine permeability, also suggest free field pore pressure values. One borehole was located in a competent predominantly halite bed with the test region positioned approximately nine meters from the rib. A second borehole intersected Marker Bed 139, which is a one meter thick fractured predominantly anhydrite layer. For this second borehole, the test region was positioned approximately 12 meters from the invert/rib intersection. A description of the tests provided in Section 2. Data obtained during these tests are described in Section 3. Analysis of these data and the associated uncertainties inherent in the data interpretation are presented in Section 4. Test results are given in Section 5. Conclusions are provided in Section 6. 13 refs., 65 figs.

11036 **(SKB-TR—86-25) Aspects of the physical state of smectite-adsorbed water.** Pusch, R.; Karnland, O. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). 31 Dec 1986. 67p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751483/JAW.

The hydration of Na montmorillonite is currently explained in two ways, which are related to different crystal structure version of this mineral. Wetting of the Edelman/Favejee structure takes place through formation of an ice-like hydrogen-bonded water lattice that grows from assumed, protruding hydroxyls in the basal planes, yielding interlamellar water of a density well below 1 g/cm/sub3/. The hydration of the conventional Hofmann/Endell/Wilm structure instead implies that interlamellar cations hydrate and that the spatial arrangement of the water therefore depends on the location of positive clay lattice charge. The molecular arrangement may thus vary and yield a density of the interlamellar water that may be lower, equal to, or higher than that of free water. The amount of interlamellar water depends on the microstructure of the clay. At bulk densities exceeding 1.6-1.8 t/m/sup3/ it constitutes 40-80 percent of the total porewater content, while at densities lower than about 1.3 t/m/sup3/ this percentage drops to less than 5. One way of finding out which of the two hydrate models that is valid at room temperature would be to determine the density of interlamellar water. Reinterpretation of published data and the outcome of recent experiments using dilatometer technique all point to an average density of such water of slightly more than 0.9 g/cm/sup3/, which suggests that ice-like water lattices are formed in the interlamellar space when Li and Na are adsorbed cations. External surfaces of stacks of montmorillonite flakes are conclude to have

negligible ordering influence in the porewater, which therefore has a density on the same order as free water. (authors). With 25 refs.

11037 (SMB-TR—86-23) Settlement of canisters with smectite clay envelopes in deposition holes. Pusch, R. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1986. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751484/JAW.

Settlement of canisters containing radioactive waste and being surrounded by dense smectite clay is caused by the stresses and heat induced in the clay. Consolidation by water expulsion of the clay underlying a model canister with 5 cm diameter and 30 cm length would theoretically account for a maximum finite settlement of about 70 my m in a few weeks, while shear-induced creep would yield a settlement of only a few microns in the same time period. These predictions were checked by running a laboratory test in which a dead load of 80 kg was applied to a small cylindrical copper canister embedded in Na bentonite. The settlement, which increased in proportion to log time, turned out to be about 6 my m in the first 2.5 months. After the first loading period at room temperature, heating to 50 degrees C and, after a 4 months long 'room temperature' period, to 70 degrees C took place. This cycling gave strong, instant settlement and upheaval because of the different thermal expansion of the interacting components of the system. After the development of constant temperature conditions in the entire system and completion of the consolidation or expansion that followed from the thermo-mechanical interactions, the settlement proceeded at a rather high rate at 70 degrees C, still following a log time creep law, but with somewhat stronger retardation. At room temperature, i.e. in the post-heating periods, the settlement seemed to cease, on the other hand. The conclusion from the study is that the canister movements under isothermal conditions were in accordance with the log t-type creep settlement that was predicted in theoretical grounds. Pre-heating and low stresses may account for extraordinary retardation of the settlement.

11038 (UCRL—15993) The influence of copper on Zircaloy spent fuel cladding degradation under a potential tuff repository condition. Smith, H.D. (Sandia National Labs., Albuquerque, NM (USA). Nevada Nuclear Waste Storage Investigations Projects Dept.). Mar 1987. Contract W-7405-ENG-48. 26p. (HEDL-SA—3583; CONF-870306—71). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004366/JAW.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

This paper reports the results of an experiment designed to detect the influence of copper on Zircaloy spent fuel cladding degradation in one possible repository environment. Copper and copper alloys are being considered for use in a tuff repository. The compatibility of a copper waste package container and the Zircaloy cladding on spent fuel has been questioned essentially because copper ion has been observed to accelerate zirconium alloy corrosion in acid environments, as does ferric iron, and a phenomenon called "crud-induced localized corrosion" is observed in some Boiling Water Reactors where thorugh-the-wall corrosion pits develop beneath copper-rich crud deposits. 16 refs., 6 figs., 2 tabs.

11039 (USGS/WRIR—86-4015) Geohydrology of rocks penetrated by test well USW G-4, Yucca Mountain, Nye County, Nevada. Lobmeyer, D.H. (Geological Survey, Lakewood, CO (USA)). 1986. Contract AI08-78ET44802. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003304/JAW.

Test well USW G-4 was drilled to a depth of 915 meters on the eastern flank of Yucca Mountain, near the southwestern part of the Nevada Test Site. The wellsite is near the site proposed for an exploratory shaft that would aid site-characterization efforts. Hydrologic tests were conducted on the saturated part of the section, which is entirely within the Miocene Crater Flat Tuff. Two pumping tests were run. Transmissivity for the entire saturated section is about 600 meters squared per day. A flow survey conducted during the second pumping test indicated that most of the water came from a zone about 10 meters thick below a depth of 892 meters. Packer-injection tests indicated that the transmissivity of the interval above 850 meters was about 7 meters squared per day. A sample collected during the first pumping test was sodium bicarbonate type water, typical of the Yucca Mountain area. Radiocarbon dating gave an apparent age of 12,160 years before present. The water level at the end of testing was 540.3 meters below land surface. 31 refs., 17 figs., 4 tabs.

11040 (WHC-EP—0008) Hanford Waste Vitrification Plant preliminary description of waste form and canister. Mitchell, D.E. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1987. Contract AC06-87RL10930. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002724/JAW.

This description is limited to information that describes the physical and chemical characteristics of the expected high-level waste form. The document covers waste form characteristics, canister characteristics, and canistered waste form characteristics. This information will be used by the candidate geologic repository projects as the basis for preliminary repository design activities and waste form testing. 5 refs., 6 figs., 5 tabs.

11041 (WHC-EP—0037) Data compilation: Iodine-129 in Hanford groundwater. Brauer, F.P.; Conners, D.A.; Deichman, J.L.; Johnson, V.G.; Routson, R.C. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1987. Contract AC06-87RL10930. 375p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE88002336/JAW.

This report summarizes all data and information about ^{129}I in the Hanford Site groundwater that could be gathered from various and diverse sources. The data compilation covers a time period from approximately 1959, when analytical methods were initiated, through the most recent drilling and sampling activities completed in 1986. More than 700 sampling events are represented in the data bases for the confined and unconfined aquifer system beneath the Hanford Site. These data, some of which were previously unpublished, are summarized in the appendixes. Primary attention is given to integration of the diverse sources of information and to development of qualification criteria for use of the data. 28 refs., 33 figs., 5 tabs.

11042 (WHC-EP—0045) Preliminary Hanford Waste Vitrification Plan Waste Form Qualification Plan. Nelson, J.L. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1987. Contract AC06-87RL10930. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002750/JAW.

This Waste Form Qualification Plan describes the waste form qualification activities that will be followed during the design and operation of the Hanford Waste Vitrification Plant to ensure that the vitrified Hanford defense high-level wastes will meet the acceptance requirements of the candidate geologic repositories for nuclear waste. This plan is based on the defense waste processing facility requirements. The content of this plan is based on the assumption that the Hanford Waste Vitrification Plant high-level waste form will be disposed of in one of the geologic repository projects. Proposed legislation currently under consideration by Congress may change or delay the repository site selection process. The impacts of this change will be assessed as details of the new legislation become available. The Plan describes activities, schedules, and programmatic interfaces. The Waste Form Qualification Plan is updated regularly to incorporate Hanford Waste Vitrification Plant-specific waste acceptance requirements and to serve as a controlled baseline plan from which changes in related programs can be incorporated. 10 refs., 5 figs., 5 tabs.

11043 (WHC-EP—0087) Estimates of solid waste buried in 100 Area burial grounds. Miller, R.L.; Wahlen, R.K. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1987. Contract AC06-87RL10930. 79p. (UNI—3908). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004474/JAW.

Previous estimates of radionuclide inventory and hazardous materials were based on extrapolations using limited historical burial records. The estimates in this report are based on the review of historical documents, on reconstruction of operating practices, and on the experiences of knowledgeable individuals involved in the disposal of wastes generated during the years of reactor oper-

ations. The major radioactive wastes in the burial grounds are 375 tons of aluminum spacers, 1103 tons of lead-cadmium pieces, boron splines (62.5 tons aluminum and 8.5 tons boron), carbon materials (2300 lb graphite and 13,200 lb desiccant), 266 tons of aluminum process tubes, and 259 tons of lead. A total of 159.2 tons of miscellaneous waste includes gunbarrels, thimbles, control rods, nozzles, pigtails, and cadmium sheets. Radionuclide inventories were calculated from the volume of each type of waste. The major contributors to the inventory numbers are tritium (hydrogen-3), carbon-14, cobalt-60, nickel-63, strontium-90, cesium-137, and europium-152 and -154. 3 refs., 12 tabs.

11044 **(Y/TS—316) Y-12 Plant waste minimization strategy.** Kane, M.A. (Oak Ridge Y-12 Plant, TN (USA)). 2 Oct 1987. Contract AC05-84OR21400. 16p. (CONF-871075—15-Vugraphs). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001816/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The Oak Ridge Y-12 Plant developed a waste minimization program to encompass all types of wastes. Waste minimization has become an integral part of the overall waste management program. Unlike traditional approaches, waste minimization focuses on controlling waste at the beginning of production instead of the end. This approach includes substituting nonhazardous process materials for hazardous ones, recycling or reusing waste effluents, segregating nonhazardous waste from hazardous and radioactive waste, and modifying processes to generate less waste or less toxic waste. This report focuses on the Y-12 Plant's strategy to implement a comprehensive waste minimization program. This approach consists of four major program elements: promotional campaign, process evaluation for waste minimization opportunities, waste generation tracking system, and information exchange network. Included are accomplishments of the program and issues that need to be resolved. The document contains only viewgraphs.

11045 **Radionuclide sorption methodologies for performance assessments of high-level nuclear waste repositories: A perspective gained from an NRC workshop.** Kelmers, A.D.; Meyer, R.E.; Blencoe, J.G.; Jacobs, G.K. (Oak Ridge National Lab., TN). *Nuclear Safety;* **28**: No. 4, 515-522(Oct-Dec 1987).

A workshop to discuss the characterization and modeling of radionuclide sorption processes in rock-water systems relevant to the isolation of high-level nuclear waste in geologic repositories was held May 13-15, 1986, by US Nuclear Regulatory Commission staff and contractors. The key recommendations of the workshop were that (1) a limited understanding of sorption phenomena will be needed to demonstrate reasonable assurance of compliance with regulatory repository-performance requirements; (2) understanding of sorption phenomena must be developed through laboratory studies complemented by field studies and consideration of natural analogues; (3) both site-specific and more fundamental laboratory studies designed to elucidate sorption mechanisms will be necessary components of a successful sorption program; (4) methods of modeling sorption that are more sophisticated than the single-value K/ sub D/ model will be needed to support repository-performance assessments; and (5) the level of sophistication of sorption models will depend on the radionuclide(s) of interest, available supporting laboratory data, and the level of isolation performance assigned to sorption processes.

11046 **Mobile non-destructive assay system.** Colarusso, A.P.; Audas, J.H.; Bieri, J.M.; Herrera, G.C.; Hastings, R.D.; Horton, W.S.; Kuckertz, T.H.; Kunz, W.E.; Medvick, P.A.; Vogel, P.A. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 375-379(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A mobile system for non-destructive assay (NDA), developed at the Los Alamos National Laboratory, provides accurate and sensitive measurements for transuranic (TRU) isotopes contained in 208-iota drums of miscellaneous nuclear wastes. The NDA unit consists of four major subsystems: an assay chamber, counting and digital electronics, data acquisition, and a neutron generator. It performs both active and passive neutron waste measurements. The former determines the amount of fissile isotopes at a sensitivity level of 1 mg plutonium. The latter determines spontaneous fission and α,n) isotopes at a comparable level. A complete assay consists of sequential active and passive measurements. The assay measurement and other supporting data are incorporated in a commercial spreadsheet program (Lotus 1,2,3) for further analysis, which includes various matrix corrections and a determination of whether or not the drum exceeds the 100-nCi/g threshold for TRU wastes. Field tests have been performed on three separate occasions, accomplishing more than 1800 waste drum assays. These waste drum assays are discussed, especially those comparing passive and active neutron measurements with independent segmented gamma scan assays. Results obtained with a set of 15 drums containing plutonium prepared from standards and actual hot waste matrices are also reviewed.

11047 **Permeability changes during shear deformation of fractured rock.** (Sandia National Labs., Albuquerque, NM). pp 473-480 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The effect of shear deformation on the permeability of fractured rock has been investigated in drained triaxial compression experiments on prefractured samples of Coconino sandstone. These experiments show that permeability across a fracture decreases with increasing shear deformation because of localized deformation along the fractures and the evolution of a gouge zone. Petrographic observations show a progressive decrease in grain size and porosity of the gouge zone with increasing shear displacement. With increasing normal stress there is a more rapid reduction in grain size and a higher degree of compaction of the gouge per increment of shear displacement, which results in a faster decline in permeability during sliding.

11048 **Evaluating design procedures for structures in rock salt.** Wawersik, W.R.; Morgan, H.S. (Sandia National Labs., Albuquerque, NM). pp 107-116 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Validating design procedures for structures in salt masses can be accelerated by suitable laboratory or benchscale experiments where in situ loading conditions with inhomogeneous stress fields and heating are simulated, controlled, and repeated. Design validations, especially data and model extrapolations, can also be supported by identifying microstructures as manifestations of the governing deformation processes. The laboratory tests described in this work use externally and internally pressurized, heated, thick-walled hollow cylinders. Microstructural studies presented entail observations on rock salt after laboratory testing and on salt from around old mine workings.

11049 **Development of diamond-tipped chain saws for slot cutting in welded tuff.** Zimmerman, R.M.; Finley, R.E.; Schuch, R.L.; Dodds, D.J. (NNWSI Geotechnical Projects Div., Sandia National Labs., Albuquerque, NM). pp 963-972 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

This paper describes the development and performance evaluations of two chain saws, one with a 1.1-m bar and the other with a 2.1-m bar, that were used to cut thin (less than 15 mm) planar slots in a jointed, welded tuff in G-tunnel on the Nevada Test Site as part of the Nevada Nuclear Waste Storage Investigations Project.

11050 **Analysis of drift convergence phenomena from G-Tunnel welded tuff mining evaluations.** Zimmerman, R.; Bellman, R.A. Jr.; Mann, K.L. (Sandia National Labs., Albuquerque, NM). pp 831-842 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract AC04-76DP00789.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

This paper discusses the results of vertical and horizontal drift convergence measurements taken during the mining of a repository-sized drift in welded tuff in G-Tunnel on the Nevada Test Site. Results are quantified in terms of drift convergence magnitudes and rates that relate to drift stability.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 10909, 10950, 10951, 10952, 10953, 10954, 10956, 10958, 10959, 10960, 10961, 10962, 10964, 10966, 10967, 10968, 10971, 10972, 10973, 10974, 10975, 10976, 10977, 10978, 10979, 10980, 10981, 10986, 10987, 11000, 11001, 11003, 11004, 11005, 11006, 11009, 11012, 11013, 11014, 11015, 11016, 11017, 11018, 11019, 11020, 11021, 11022, 11023, 11024, 11025, 11026, 11027, 11028, 11029, 11030, 11031, 11032, 11033, 11034, 11035, 11038, 11039, 11040, 11041, 11042, 11043, 11044, 11045, 11053, 12514, 12516, 12520, 12521, 12573, 12660, 12667

11051 (IPEN-Pub—112, pp 108) **Evaluation of solidified cement waste forms.** Rzyski, B.M.; Suarez, A.A. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

Concrete has been suggested as a promising encapsulation or overpack material for long-term storage of radioactive waste from the nuclear fuel cycle, particularly in conjunction with the disposal of low-and intermediate-level waste. This paper was conducted to investigate the influence of sodium nitrates, as a possible integrating component of waste, on some properties of national Portland cement. The waste form properties, discussed in terms of their dependence on waste type and amount, include water-cement ratio-W/C, setting times, compressive strenght and homogeneity. Criteria to be applied in the assessment of the final solidified waste are proposed.

11052 **(Y/TS—317) Radiological stack monitoring at the Y-12 Plant.** Powell, J.E. (Oak Ridge Y-12 Plant, TN (USA)). 15 Oct 1987. Contract AC05-84OS21400. 10p. (CONF-871075—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001818/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

This paper provides information on the Oak Ridge Y-12 Plant's Radiological Stack Monitoring Program. The Y-12 Plant Radiological Stack Monitoring Program has recently undergone significant change at considerable expense and effort. The final product of the one and one-half year long stack monitoring upgrade effort is now operational and producing high-quality, reliable results at the Oak Ridge Y-12 Plant. It is hoped that by understanding the comprehensive Y-12 Plant Radiological Stack Monitoring Program other environmental managers can assess their own program and identify potential solutions to complex challenges in the radiological stack monitoring arena.

0540 Health And Safety

REFER ALSO TO CITATION(S) 10957, 11005, 11007, 11008, 12514, 12521, 12660, 12667, 12678, 12681, 12682, 13732

11053 **(DOE/DP/93032—T2) Scientific basis for risk assessment and management of uranium mill tailings.** (National Research Council, Washington, DC (USA). Uranium Mill Tailings Study Panel). 1986. Contract AC01-84DP93032. 262p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88003543/JAW.

A National Research Council study panel, convened by the Board on Radioactive Waste Management, has examined the scientific basis for risk assessment and management of uranium mill tailings and issued this final report containing a number of recommendations. Chapter 1 provides a brief introduction to the problem. Chapter 2 examines the processes of uranium extraction and the mechanisms by which radionuclides and toxic chemicals contained in the ore can enter the environment. Chapter 3 is devoted to a review of the evidence on health risks associated with radon and its decay products. Chapter 4 provides a consideration of conventional and possible new technical alternatives for tailings management. Chapter 5 explores a number of issues of comparative risk, provides a brief history of uranium mill tailings regulation, and concludes with a discussion of choices that must be made in mill tailing risk management. 211 refs., 30 figs., 27 tabs.

11054 **(UCRL—50007-86) Hazards Control Department: Annual technology review, 1986.** Griffith, R.V.; Anderson, K.J. (eds.). (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88002249/JAW.

The Annual Technology Review highlights some of the research performed in the Lawrence Livermore National Laboratory (LLNL) Hazards Control Department. The seven major sections in the Annual cover scientific concerns in the areas of Industrial Hygiene, Chemical Protective Equipment, Accident Analysis, Fire Science, Aerosol Physics, Criticality Safety, and Dosimetry. For a broader overview of the types of work performed in the Hazards Control Department, the abstracts of recent publications by Department members are included.

11055 **(UCRL—97475) LLNL Pressure Safety Program.** Borzileri, C.V. (Lawrence Livermore National Lab., CA (USA)). 7 Oct 1987. Contract W-7405-ENG-48. 15p. (CONF-8710202—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001874/JAW.

From Gas technology IMOG subgroup meeting; Livermore, CA, USA (13 Oct 1987).

This report briefly describes a program of training and certification for laboratory personnel who design, install, or operate pressure equipment. Signature authority and access documentation are required for each piece of equipment. Four training courses reflect the four pressure levels found in equipment at the laboratory. Most of this report consists of viewgraphs from the presentation. (TEM)

11056 **Herbert M. Parker: Publications and contributions to radiological and health physics.** Kathren, R.L.; Baalman, R.W.; Bair, W.J. Columbus, OH; Battelle Press (1986). 822p. Battelle Press, 505 King Avenue, Columbus, OH 43201.

For more than a half century, Herbert M. Parker was a leading force in radiological physics. As a scientist, he was codeveloper of a systematic dosimetry scheme for implant therapy and the innovative proposer of radiological units with unambiguous physical and biological bases. He made seminal contributions to the development of scientifically based radiation protection standards and, as an administrator and manager as well as scientist, helped the Hanford Laboratories to achieve preeminance in several areas, including radiation biology, radioactive waste disposal, and environmental radioactivity. This volume brings together, sometimes from obscure sources, his works.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 10911, 10912, 10915, 11046, 11503, 11504, 12356, 12409

11057 **(CONF-870837—1) Pattern-recognition software for plant surveillance.** Mott, J.; Young, R.; King, R. (EI International, Inc., Idaho Falls, ID (USA); Argonne National Lab., Idaho Falls, ID (USA)). 1987. Contract W-31109-ENG-38. 34p. NTIS, PC A03. Order Number DE88003029/JAW.

From 13. American Nuclear Society international meeting on nuclear power plant operation; Chicago, IL, USA (30 Aug 1987).

A very general mathematical framework for embodying learned data from a complex system and combining it with a current observation to estimate the true current state of the system has been implemented using nearly universal pattern-recognition algorithms and applied to surveillance of the EBR-II power plant. In this application the methodology can provide signal validation and replacement of faulty signals on a near-real-time basis for hundreds of plant parameters. The mathematical framework, the pattern-recognition algorithms, examples of the learning and estimating process, and plant operating decisions made using this methodology are discussed. The entire methodology has been reduced to a set of FORTRAN subroutines which are small, fast, robust and executable on a personal computer with a serial link to the system's data acquisition computer, or on the data acquisition computer itself.

11058 (CONF-871110—5) Design of a study of Systems Analysis for Material Control and Accountancy Technology (SAMCAT). Persiani, P.J.; Rothman, A.B.; Bucher, R.G.; Daly, T.A.; Cha, B.C.; Trevorrow, L.E.; Seefeldt, W.B.; Stewart, W.E. (Argonne National Lab., IL (USA); Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002879/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

The Systems Analysis for Material Control and Accountancy (MC & A) Technology, SAMCAT, is a program to develop an interactive computer-based management system for decision support in evaluating MC & A upgrades and for validating the MC & A aspects of the Master Safeguards and Security Agreements (MSSA) effectiveness. Facility operators, staff from Department of Energy (DOE) headquarters and field offices, and staff from government laboratories comprise the research and development group responsible for this program. This paper briefly reviews SAMCAT and presents the status of current activities, with primary focus on the design of a pilot study which has been planned for the near-term development program. The objective of the pilot study is to aid in the development and testing of assessment technologies by utilizing data and information from recent upgrades in MC & A measurements at several of the measurement locations which were important contributors to the uncertainty of the inventory differences (IDs) for a specific material balance area (MBA). The FB-Line MBA in the plutonium production cycle through Savannah River was recommended as a candidate MBA for the study. Attributes considered as selection criteria of key measurement locations for MC & A upgrades, importance rankings of the measurement locations, modeling approaches in evaluating the effectiveness of upgrades at given locations, and the data requirements to support the pilot study are presented. Applications of the near-term pilot study to the overall SAMCAT development program are also presented.

11059 (DP-MS—87-63) NDA [nondestructive assay] for a facility at SRP. Studley, R.V. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract AC09-76SR00001. 8p. (CONF-871110—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003314/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

A near-real-time accountability system with associated high accuracy assay measurements has recently been placed in service at a Savannah River Plant (SRP) facility. A computer cluster provides facility wide communication between personnel and the accountability, process control, and laboratory data systems. The cluster is also connected to communicate with process, accountability, and laboratory instrumentation and process controls plus an item tracking bar code printer/reader system. Eight high performance microprocessor-based nondestructive assay (NDA) systems which were developed at the Los Alamos National Laboratory (LANL) for this process are also connected to this cluster. With standards developed for them, these instruments are achieving the highest currently known NDA measurement accuracies.

11060 (IAEA-RL—152) Destructive analytical services to safeguards: Activity report 1984-1987. Bagliano, G. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Aug 1987. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700800/JAW.

The report gives an evaluation of the volume, delays and quality of destructive analytical services provided in 84/01/01-87/06/30 in support of Agency Safeguards. General observations are also made. Problems and improvements are identified and trends indicated. The main features of the considered period are as follows: a) About 4,100 inspections samples were received and analyzed in the period 84/01/01-87/06/30 by SAL and NWAL. The samples represented 20 different types of materials issued from different nuclear fuel cycles. b) 496 out of 895 spent fuel samples analyzed in this period were distributed to NWAL. c) The chemical and isotopic analyses of Uranium, Thorium and Plutonium requested by the Inspectors (Americium also but occasionally) resulted in the report of a total of about 14,200 analytical results. d) The calibration of on-site measurements, the certification of Working Reference Materials for Destructive Analysis and the maintenance and improvement of Destructive Analysis required additional analytical services which were provided. e) At present, compared to 1983, the total verification delays by DA were shortened by 16%, 57% and 55% respectively for Uranium, Plutonium and spent fuel materials. f) Timely detection of abrupt diversion is achievable for the low enriched Uranium samples and are close to be achievable for the Plutonium and Spent Fuel Samples. g) Concepts, Procedures, and Materials for Analytical Quality Control Programmes of the measurements performed at SAL and NWAL were prepared. The analysis performed can be adequately accurate. h) Problems continue however to be encountered in the quality of the overall DA verification system. i) Major upgrading of equipment and procedures was undertaken at SAL. j) Other selective chemical assays were being tested and Isotope Dilution Mass Spec assays have been successfully set up for the analysis of 3 mg-sized Plutonium product samples. (Abstract Truncated)

11061 (LA—11061-MS) Optimal allocation of International Atomic Energy Agency inspection resources. Markin, J.T. (Los Alamos National Lab., NM (USA)). Dec 1987. Contract W-7405-ENG-36. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003394/JAW.

The Safeguards Department of the International Atomic Energy Agency (IAEA) conducts inspections to assure the peaceful use of a state's nuclear materials and facilities. Because of limited resources for conducting inspections, the careful disposition of inspection effort among these facilities is essential if the IAEA is to attain its safeguards goals. This report describes an optimization procedure for assigning an inspection effort to maximize attainment of IAEA goals. The procedure does not require quantitative estimates of safeguards effectiveness, material value, or facility importance. Instead, the optimization is based on qualitative, relative prioritizations of inspection activities and materials to be safeguarded. This allocation framework is applicable to an arbitrary group of facilities such as a state's fuel cycle, the facilities inspected by an operations division, or all of the facilities inspected by the IAEA.

11062 (LA-UR—87-3677) Current segmented gamma-ray scanner technology. Bjork, C.W. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-871110—11). NTIS, PC A02. Order Number DE88003182/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

A new generation of segmented gamma-ray scanners has been developed at Los Alamos for scrap and waste measurements at the Savannah River Plant and the Los Alamos Plutonium Facility. The new designs are highly automated and exhibit special features such as good segmentation and thorough shielding to improve performance.

11063 **(LA-UR—87-3896) A comparison of conventional and prototype nondestructive measurements on molten salt extraction residues.** Longmire, V.L.; Hurd, J.R.; Sedlacek, W.E.; Scarborough, A.M. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 6p. (CONF-871110—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003162/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

Fourteen molten salt extraction residues were assayed by conventional and prototype nondestructive assay (NDA) techniques to be compared with destructive chemical analysis in an effort to identify acceptable NDA measurement methods for this matrix. NDA results on seven samples and destructive results on four samples are presented.

11064 **(LA-UR—87-3954) Recent advances in segmented gamma scanner analysis.** Sprinkle, J.K. Jr.; Hsue, S.T. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-871110—9). NTIS, PC A02. Order Number DE88003151/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

The segmented gamma scanner (SGS) is used in many facilities to assay low-density scrap and waste generated in the facilities. The procedures for using the SGS can cause a negative bias if the sample does not satisfy the assumptions made in the method. Some process samples do not comply with the assumptions. This paper discusses the effect of the presence of lumps on the SGS assay results, describes a method to detect the presence of lumps, and describes an approach to correct for the lumps. Other recent advances in SGS analysis are also discussed.

11065 **(MLM—3466) Security guide for subcontractors.** (Monsanto Research Corp., Miamisburg, OH (USA). Mound). Jan 1988. Contract AC04-76DP00053. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003505/JAW.

The objectives of security in the Department of Energy (DOE) contractor/subcontractor program are: (1) to ensure the protection of information which, if related, would endanger the common defense and security of the nation; and (2) to safeguard the plants and installations of the DOE and its contractors in order that research and production programs will not be interrupted. To achieve these objectives, security responsibilities have been divided into three interdependent categories: personnel security, physical security, and security education and quality audits. This guide presents instructions for implementing a security program at a contractor/subcontractor site.

11066 **How attractive is your SNM.** Erkkila, B.H. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* 16: 84-85(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The goal of a well designed safeguards system is the proper protection of various categories of Special Nuclear Material (SNM). In the past the quantity of SNM was the primary concern when defining categories. The form of the SNM is also important in a safeguards system. To a diverter of material pure metal, for example, could be much more attractive than a nitrate solution. The design of a universal attractiveness table along with performance criteria for the safeguards system is a very complex problem. Several approaches to a solution will be discussed.

11067 **Nuclear Materials Management and Safeguards System (NMMSS).** Baird, P.W.; Jacobsen, S.E.; Matthews, W.B.; Pedigo, R.B. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* 16: 283-285(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This paper describes the Nuclear Materials Management and Safeguards System (NMMSS) which is sponsored by the Department of Energy and the Nuclear Regulatory Commission. The system serves national security and program management interests, and international interests in the programs for the peaceful application of nuclear energy and non-proliferation of nuclear weapons. Within the scope of the NMMSS are found all nuclear materials applied and controlled under United States law and related international agreements, including U.S. nuclear materials production programs and U.S. private nuclear industrial activities. In addition, its national and international scope enables it to provide services to other organizations such as the Arms Control and Disarmament Agency, the Department of State, and the U.S. Congress.

11068 **Safeguards: Where have we been...Where should we be going.** Seaton, M.B. (Dept. of Energy, Washington, DC). *Journal of Nuclear Materials Management;* 16: 1-3(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This presents the author's point of view as DOE manager on where safeguards should be going. The field has been developing since Manhattan Project days as a system, a technology and people. Present DOE safeguards are being studied. Needs for improvement being evaluated include demographic changes in the labor force and fundamental response measures. Some help can be given to others with related needs.

11069 **Validating safeguards effectiveness given inherently limited test data.** Sicherman, A. (Lawrence Livermore National Lab., Livermore, CA). *Journal of Nuclear Materials Management;* 16: 54-58(Jul 1987). (CONF-870713—). Contract W-7405-ENG-48.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A key issue in designing and evaluating nuclear safeguards systems is how to validate safeguards effectiveness against a spectrum of potential threats. Safeguards effectiveness is measured by a performance indicator such as the probability of defeating an adversary attempting a malevolent act. Effectiveness validation means a testing program that provides sufficient evidence that the performance indicator is at an acceptable level. Traditional statistical program when numerous independent system trials are possible. However, within the safeguards environment, many situations arise for which traditional statistical approaches may be neither feasible nor appropriate. Such situations can occur, for example, when there are obvious constraints on the number of possible tests due to operational impacts and testing costs. Furthermore, these tests are usually simulations (e.g., staged force-on-force exercises) rather than actual tests, and the system is often modified after each test. Under such circumstances, it is difficult to make and justify inferences about system performance by using traditional statistical techniques. In this paper, the authors discuss several alternative quantitative techniques for validating system effectiveness. The techniques include: (1) minimizing the number of required tests using sequential testing; (2) combining data from models inspections and exercises using Bayesian statistics to improve inferences about system performance; and (3) using reliability growth and scenario modeling to help specify which safeguards elements and scenarios to test.

11070 **Safeguards seals activities update.** Waddoups, I.G.; Rao, M. (Sandia National Labs., P.O. Box 5800, Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* 16: 192-196(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Ongoing commercial developments, some Department of Energy (DOE) contractor-initiated developments, and the desire to standardize seals and procedures stimulated the establishment of a seals task force to assess the current seals situation, develop reference material to assist in standardization, and recommend appropriate long-term activities. This paper summarizes the results of the task force effort and briefly discusses some of the more recent domestic seals developments.

11071 **Technology development for insider protection.** Waddoups, I.G.; Ortiz, S.; Trujillo, A.A. (Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* 16: 185-188(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Available technology has been applied to observing personnel and material movements as a means for providing earlier detection of errant insider activities. A demonstration system utilizing proximity badges, bar codes, and dynamic tamper indicators has been installed and evaluated for effectiveness in monitoring personnel and item movements. The dynamic tamper indicators were also installed at another facility to evaluate their effectiveness as both an insider protection element and a near real-time item inventory monitor. Studies to support these and other applications confirm that the manner in which cost effective insider protection can be provided is much more site-specific than are outsider protection schemes.

11072 **ARC/SPAR sealing system - Preliminary field evaluation.** Brauneisen, J.F.; Smith, M.T.; Dennys, R.; Yellin, E.; Mc Kenzie, J.M.; Self, B.G.; Walker, J.E. (AECB). *Journal of Nuclear Materials Management;* 16: 400-405(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The ARC/SPAR sealing system, based on an ultra-sonic signature and designed for sealing CANDU-type spent fuel, has been undergoing field evaluation at Gentilly-2 600 MW Reactor for the last ten months. The test was designed to evaluate the hardware and software of the system, the effort required for the application and verification of the containment and seals, the interference with operator, the procedures and the false- and missed alarm rates. Routine use conditions were emphasized throughout the test. In the course of the trial the entire content of the spent fuel in the pond was sealed. Preliminary results indicate that the system is acceptable. Hardware, software and procedures except for the transducer worked well. Transducer failure occurred too frequently at an unacceptable rate. The problem was identified and will hopefully be overcome. Level of intrusion with operations could be considered acceptable. Inspectors carrying out seal application and verification were adequately trained and performed satisfactorily. Auto- and crosscorrelations are reported. Recommendations are made for the improvement of equipment and procedures. The test will continue until the end of this year.

11073 **U.S. Department of Energy International Safeguards Program-containment and surveillance activities.** Myers, D.A.; Mangan, D.L.; Sonnier, C.S. (Dept. of Energy, Washington, DC). *Journal of Nuclear Materials Management;* 16: 380-382(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Material accounting is currently the fundamental element of International Safeguards as applied by the International Atomic Energy Agency (IAEA), with Containment and Surveillance (C/S) serving an important complementary role. Because of limited IAEA resources and the increasing number of nuclear facilities, it is commonly recognized that increased reliance may have to be placed on C/S equipment. For more than a decade, C/S has been an important element of the DOE International Safeguards Program, with Sandia National Laboratories serving as the "Center of Excellence" for the DOE C/S activities. These activities are divided into three major categories - C/S-based Safeguards Design and Strategies, C/S Technology Development, and Technology Exchange. This paper describes the objective of each of these activities, the principal accomplishments, the current activities, and planned future activities.

11074 **A measurement control program for calorimeters and gamma isotopic instruments.** Hsue, F. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* 16: 371-374(Jul 1987). (CONF-870713—).

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The combination of the calorimetry and plutonium isotopic measurements to determine the total plutonium mass nondestructively has become increasingly more important at the Los Alamos Plutonium Facility. A measurement control program has been developed and implemented for these two types of systems. The program serves two major functions. It provides a near real-time check of the instrumental bias and precision. It also provides a data base for monitoring the systematic and random errors associated with each instrument. At the present, there are six calorimeters and four isotopic systems operating under this program. This paper describes the measurement control program and presents an assessment of 2 years of data from the 10 instruments.

11075 **Application of prediction of equilibrium to servo-controlled calorimetry measurements.** Mayer, R.L. II. (Monsanto Research Corp., Mound, Miamisburg, OH 45342). *Journal of Nuclear Materials Management;* 16: 364-370(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Research was performed to develop an endpoint prediction algorithm for use with calorimeters operating in the digital servo-controlled mode. The purpose of this work was to reduce calorimetry measurement times while maintaining the high degree of precision and low bias expected from calorimetry measurements. Data from routine operation of two calorimeters were used to test predictive models at each stage of development against time savings, precision, and robustness criteria. The results of the study indicated that calorimetry measurement times can be significantly reduced using this technique. The time savings is, however, dependent on parameters in the digital servo-control algorithm and on packaging characteristics of measured items.

11076 **A study of in-line plutonium isotopic analysis for gaseous plutonium hexafluoride.** Li, T.K. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* 16: 359-363(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

In-line plutonium isotopic analysis of gaseous plutonium hexafluoride (PuF/sub 6/) is very important for process control and special nuclear material accountability in any plutonium isotope separation process that requires a gaseous phase. Although much effort had been devoted to analyze arbitrary plutonium samples, no isotopic analysis had been done on gaseous PuF/sub 6/ samples. The authors have initiated a study on the use of a high-resolution, gamma-ray spectroscopy technique to analyze gaseous plutonium hexafluoride. For the first time, PuF/sub 6/ gas samples with pressures varying from 0.15 to 31 torr, which were directly fed into a gas cell from a process flow loop, were measured. The isotopic results of these measurements of gaseous PuF/sub 6/ agree very well with those of mass spectrometry measurements of solid PuF/sub 4/ . The precision of a 10-min measurement of a 10-torr reactor-grade PuF/sub 6/ is 1.5% for /sup 238/Pu, 0.22% for /sup 239/Pu, 0.87% for /sup 240/Pu, and 17.5% for /sup 241/Pu.

11077 **MGA2: A one-detector code for rapid high-precision plutonium isotopic measurements.** Gunnink, R. (Lawrence Livermore National Lab., Livermore, CA 94550). *Journal of Nuclear Materials Management;* 16: 352-358(Jul 1987). (CONF-870713—). Contract W-7405-ENG-48.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The MGA (Multiple Group Analysis) code which we developed several years ago required two detectors when analyzing high /sup 241/Pu content samples. The isotopic information, which was obtained from the 300-keV regions, can now be obtained equally well from the low-energy region (50-208 keV). This breakthrough was achieved by developing a unique and highly accurate method for delineating the overall "intrinsic" efficiency curve, including the plutonium K-shell absorption edge discontinuity. Consequently, the intense 129- and 148-keV peak intensities can now be used reliably in place of the peaks in the 300-keV regions to determine the relative abundances of /sup 239/Pu and /sup 241/Pu. The 203/208- and 148/152-keV pairs, and all of the intense 94- to 104-keV peaks,

are included in the analysis to provide accurate data for the other isotopes of interest.

11078 A design methodology for materials control and accounting information systems. Helman, P.; Strittmatter, R.B. (Univ. of New Mexico, Dept. of Computer Science, Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 345-351(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Modern approaches to nuclear materials safeguards have significantly increased the data processing needs of safeguards information systems. Implementing these approaches will require developing efficient, cost-effective designs. Guided by database design research, we are developing a design methodology for distributed materials control and accounting (MCandA) information systems. The methodology considers four design parameters: network topology, allocation of data to nodes, high-level global processing strategy, and local file structures to optimize system performance. Characteristics of system performance that are optimized are response time for an operation, timeliness of data, validity of data, and reliability. The ultimate goal of the research is to develop a comprehensive computerized design tool specifically tailored to the design of MCandA systems.

11079 Overview of an automated, near realtime materials accounting system in use at the Savannah River plant. Clark, W.C. Jr. (E.I. du Pont de Nemours and Co., Savannah River Plant, Aiken, SC 29808). *Journal of Nuclear Materials Management;* 16: 335-338(Jul 1987). (CONF-870713—). Contract AC09-76SR00001.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A reliable material accounting system is a requirement for the operation of any nuclear facility. At the Savannah River Plant, an automated, near realtime, accounting system has been developed to provide such reliability. The system's design provides timely detection of diversion or accounting problems by monitoring the activity in 18 unit process areas (UPAs). Material balance calculations are performed for each UPA after a batch of material has completed a processing step. Small quantities of material are used for each batch, resulting in a high frequency of material balance calculations. In most cases, an inventory difference (ID) for a UPA is established at least every 24 hours. Detection of an accounting problem is further enhanced by an online measurement control program. This program evaluates the performance of most measurement equipment every 12 hours. An estimated measurement error, derived from the control tests, is maintained for each device. Error estimates are propagated when a material balance is closed to provide a realtime limit of error for the inventory difference.

11080 Ultrasonic identity data storage and archival system. Mc Kenzie, J.M.; Self, B.G.; Walker, J.E. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 316-317(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Ultrasonic seals are being used to determine if an underwater stored spent fuel container has been compromised and can be used to determine if a nuclear material container has been compromised. The Seal Pattern Reader (SPAR) is a microprocessor controlled instrument which interrogates an ultrasonic seal to obtain its identity. The SPAR can compare the present identity with a previous identity, which it obtains from a magnetic bubble cassette memory. A system has been developed which allows an IAEA inspector to transfer seal information obtained at a facility by the SPAR to an IAEA-based data storage and retrieval system, using the bubble cassette memory. Likewise, magnetic bubbles can be loaded at the IAEA with seal signature data needed at a facility for comparison purposes. The archived signatures can be retrieved from the data base for relevant statistical manipulation and for plotting.

11081 Watch - a low-cost, secure-item monitoring system. Sanderson, S.N. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 310-315(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Sandia National Laboratories has developed a remote sensor package that provides a low-cost, convenient way of monitoring item movement. Originally, the package was intended for use in valve monitoring, but it is now possible to use it in any sensor application where hardwire installation is impractical or uneconomical. Full system implementation includes a receiver/controller which correlates the arrival time of RF signals generated by item-monitoring transmitters to increase communication security. Wireless Alarm Transmission of Contained Handling (WATCH) is such a system. One important application of WATCH is in storage vaults where there are a number of material containers. Applying WATCH to inventory control reduces inventory workload and employee exposure rates; the system also provides quick access to inventory information by interfacing the system with plant site computer systems.

11082 Mobile robot vehicles for physical security. Mc Govern, D.E. (Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* 16: 306-309(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A fleet of vehicles is being developed and maintained by Sandia National Labs for studies in remote control and autonomous operation. These vehicles range from modified commercial vehicles to specially constructed mobile platforms and are utilized as test beds for developing concepts in the application of robotics to interior and exterior physical security. Actuators control the vehicle speed, brakes, and steering through manual input from a remote driving station or through some level of digital computer control. On-board processing may include simple vehicle control functions or may allow for unmanned, autonomous operation. Communication links are provided for digital communication between control computers, television transmission for vehicle vision, and voice for local control. With these vehicles, SNL can develop, test, and evaluate sensors, processing requirements, various methods of actuator implementation, operator controlled feedback requirements, and vehicle operations. A description of the major features and uses for each of the vehicles in the fleet is provided.

11083 The SAVI Vulnerability Analysis Software Package. Mc Aniff, R.J.; Paulus, W.K.; Key, B.; Simpkins, B. (Facility Systems Development Div., Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* 16: 295-298(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

SAVI (Systematic Analysis of Vulnerability to Intrusion) is a new PC-based software package for modeling Physical Protection Systems (PPS). SAVI utilizes a path analysis approach based on the Adversary Sequence Diagram (ASD) methodology. A highly interactive interface allows the user to accurately model complex facilities, maintain a library of these models on disk, and calculate the most vulnerable paths through any facility. Recommendations are provided to help the user choose facility upgrades which should reduce identified path vulnerabilities. Pop-up windows throughout SAVI are used for the input and display of information. A menu at the top of the screen presents all options to the user. These options are further explained on a message line directly below the menu. A diagram on the screen graphically represents the current protection system model. All input is checked for errors, and data are presented in a logical and clear manner. Print utilities provide the user with hard copies of all information and calculated results.

11084 Valve position monitoring devices. Pierce, L.L.; Hoover, C.E. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 293-294(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Sandia National Laboratories of Albuquerque, New Mexico, is the physical protection research and development lead laboratory for the U.S. Department of Energy (DOE). A research project was initiated to provide devices for monitoring components vital to the

safe and secure operation of a facility and to conduct a survey for the availability of valve monitors from commercial sources.

11085 **An emergency inventory system at the Oak Ridge Y-12 plant.** Smith, S.E. (Oak Ridge Y-12 Plant, Martin Marietta Energy Systems, Inc., Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* **16**: 290-292(Jul 1987). (CONF-870713—). Contract AC05-84OR21400.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A portable, computerized system for taking an emergency inventory of special nuclear materials (SNM) is in operation at the Oak Ridge Y-12 Plant. It is identified as the EIS (Emergency Inventory System). Prior to 1986, the physical inventory and reconciliation system for an emergency situation was operated completely by hand. Under the old system, SNM was listed (using pencil and paper) and then visually compared to an up-to-date computer printout of the book inventory. Under the new system, the listing process has been automated using bar-code technology and all comparisons are done on a personal computer. The components of the EIS are easily transported to any area of the plant where an inventory might have to be taken. The easy-to-use, menu-driven programming for the system is written in a widely used database management language that is standardized and easily upgraded. The EIS has been in use for over a year and has functioned quite satisfactorily. The benefits realized from the system are improved speed and accuracy of an emergency inventory, thus enhancing the safeguarding of the plant's SNM by more quickly determining if there is any unaccounted for material in an emergency situation. This paper discusses the development, operation, hardware, and software of the EIS.

11086 **Troublesome transportation concerns can be mitigated - RADMAT tracking system.** Harmon, L.H. (U.S. Dept. of Energy, Washington, DC 20545). *Journal of Nuclear Materials Management;* **16**: 278-281(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

There are three troublesome institutional concerns which face every large-quantity radioactive materials shipment - routing, pre-notification, and emergency response. People want to know: where's the shipment going and how's it getting there? States want to know what's being shipped and when? What kind of response to accidents is needed for this shipment and who'll respond? DOE is developing a transportation tracking system, based on a rapidly developing technology to determine geographical location using geo-positioning satellite systems. This technology will be used to track unclassified radioactive materials shipments in real-time. It puts those charged with monitoring transportation status on top of every shipment. Besides its practical benefits in the areas of logistics planning and execution, it demonstrates emergency preparedness has indeed been considered and close monitoring is possible. This paper will describe the system's technical detail, DOE plans and policy for its implementation, and the state of satellite positioning technology.

11087 **Variance calculations for materials accounting system design and evaluation.** Thomas, K.E. (Los Alamos National Lab., Safeguards Systems Group, Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 494-498(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Error propagation/variance calculations are used for establishing alarm limits for materials balance closures. Variance calculations may also be employed in the evaluation of accounting system designs for a proposed facility, as well as for upgrades of existing facilities. Information from such an exercise may be used to allocate resources for system improvements and identify process areas that require strict access or material controls. Simplifying assumptions are normally required since detailed data are not available for proposed facilities and may be difficult to obtain for existing facilities. Transfer, inventory, and measurement data are input into a code that calculates the variance for each term in the materials balance equation. Provision should be made for treatment of measurement correlations and holdup. The results are analyzed to determine major contributors to the total materials balance area (MBA) variance. A sensitivity analysis may be performed to determine the effect of changes in the measurements, measurement errors, or MBA structure. Examples of how variance calculations are used in accounting system analysis are discussed in the paper.

11088 **Variance and covariance calculations for nuclear materials accounting using 'MAVARIC'.** Nasseri, K.K. (Los Alamos National Lab., Safeguards Systems Group, Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 489-493(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Determination of the detection sensitivity of a materials accounting system to the loss of special nuclear material (SNM) requires (1) obtaining a relation for the variance of the materials balance by propagation of the instrument errors for the measured quantities that appear in the materials balance equation and (2) substituting measured values and their error standard deviations into this relation and calculating the variance of the materials balance. MAVARIC (Materials Accounting VARIance Calculations) is a custom spreadsheet, designed using the second release of Lotus 1-2-3, that significantly reduces the effort required to make the necessary variance (and covariance) calculations needed to determine the detection sensitivity of a materials accounting system. Predefined macros within the spreadsheet allow the user to carry out long, tedious procedures with only a few keystrokes. MAVARIC requires that the user enter the following data into one of four data tables, depending on the type of the term in the materials balance equation; the SNM concentration, the bulk mass (or solution volume), the measurement error standard deviations, and the number of measurements made during an accounting period. The user can also specify if there are correlations between transfer terms. Based on these data entries, MAVARIC can calculate the variance of the materials balance and the square root of this variance, from which the detection sensitivity of the accounting system can be determined.

11089 **A general approach to error propagation.** Sanborn, J.B. (Brookhaven National Lab., Upton, NY 11973). *Journal of Nuclear Materials Management;* **16**: 483-488(Jul 1987). (CONF-870713—). Contract AC02-76CH00016.

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A computational approach to error propagation is explained. It is shown that the application of the first-order Taylor theory to a fairly general expression representing an inventory or inventory-difference quantity leads naturally to a data structure that is useful for structuring error-propagation calculations. This data structure incorporates six types of data entities: (1) the objects in the material balance, (2) numerical parameters that describe these objects, (3) groups or sets of objects, (4) the terms which make up the material-balance equation, (5) the errors or sources of variance and (6) the functions or subroutines that represent Taylor partial derivatives. A simple algorithm based on this data structure can be defined using formulas that are sums of squares of sums. The data structures and algorithms described above have been implemented as computer software in FORTRAN for IBM PC-type machines. A free-form data-entry format allows users to separate data as they wish into separate files and enter data using a text editor. The program has been applied to the computation of limits of error for inventory differences (LEIDs) within the DOE complex.

11090 **A simulation model for material accounting systems.** Coulter, C.A.; Thomas, K.E. (Los Alamos National Lab., Safeguards Systems Group, Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 478-482(Jul 1987). (CONF-870713—).

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A general-purpose model that was developed to simulate the operation of a chemical processing facility for nuclear materials has been extended to describe material measurement and accounting procedures as well. The model now provides descriptors for material balance areas, a large class of measurement instrument types and their associated measurement errors for various classes of mate-

rials, the measurement instruments themselves with their individual calibration schedules, and material balance closures. Delayed receipt of measurement results (as for off-line analytical chemistry assay), with interim use of a provisional measurement value, can be accurately represented. The simulation model can be used to estimate inventory difference variances for processing areas that do not operate at steady state, to evaluate the timeliness of measurement information, to determine process impacts of measurement requirements, and to evaluate the effectiveness of diversion-detection algorithms. Such information is usually difficult to obtain by other means. Use of the measurement simulation model is illustrated by applying it to estimate inventory difference variances for two material balance area structures of a fictitious nuclear material processing line.

11091 **Designing new nuclear chemical processing plants for safeguards accountability.** Sprouse, K.M. (Rocketdyne Div., Rockwell International, Canoga Park, CA 91304). *Journal of Nuclear Materials Management;* **16**: 474-477(Jul 1987). (CONF-870713—).

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New nuclear chemical processing plants will be required to develop material accountability control limits from measurement error propagation analysis rather than historical inventory difference data as performed in the past. In order for measurement error propagation methods to be viable alternatives, process designers must ensure that two nondimensional accountability parameters are maintained below 0.1. These parameters are ratios between the material holdup increase and the variance in inventory difference measurement uncertainty. Measurement uncertainty data for use in error propagation analysis is generally available in the open literature or readily derived from instrument calibration data. However, nuclear material holdup data has not been adequately developed for use in the material accountability design process. Long duration development testing on isolated unit operations is required to generate this necessary information.

11092 **Emergency management information system (EMINS).** Desonier, L.M. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* **16**: 467-469(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

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In a time of crisis or in an emergency, a manager is required to make many decisions to facilitate the proper solution and conclusion to the emergency or crisis. In order to make these decisions, it is necessary for the manager to have correct up-to-date information on the situation, which calls for an automated information display and entry process. The information handling needs are identified in terms of data, video, and voice. Studies of existing Emergency Operations Centers and evaluations of hardware and software have been completed. The result of these studies and investigations is the design and implementation of an automated Emergency Management Information System. Not only is the system useful for Emergency Management but for any information management requirement.

11093 **An electronically enhanced security system using plastic scintillators for special nuclear material detection.** Jasper, P.P. Jr. (Rockwell International, Rocky Flats Plant, Golden, CO 80402). *Journal of Nuclear Materials Management;* **16**: 461-466(Jul 1987). (CONF-870713—).

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The Electronically Enhanced Security System at the Department of Energy Rocky Flats Plant (RFP), operated by Rockwell International, in Golden, Colorado, includes a Special Nuclear Material (SNM) monitoring system. It was designed by RFP to operate in areas where there is variable radiation background and high volumes of pedestrian traffic. The SNM monitors, or radiometric scanners, using plastic scintillator detectors and microprocessor-based electronics, are placed at entrance/exit doors of SNM processing areas within production buildings. The Enhanced Security System has numerous areas or posts that are each monitored by the following equipment for alarm detection: plastic scintillators, solid-state color cameras, microwave occupancy detectors, and audio and visual alarmed condition indicators. At centralized guard posts, assessment of an alarm is accomplished by using time-lapse color video cassette recorders, alarm annunciators, an intercom system, dedicated color monitors, and an alarm color monitor. As a pilot program, the Enhanced Security System accomplished a considerable yearly cost savings.

11094 **A neutron portal monitor for vehicles.** Coop, K.L.; Fehlau, P.E.; Atwater, H.F. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 454-460(Jul 1987). (CONF-870713—).

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The authors have designed and built a portal vehicle monitoring system for detecting neutron-emitting special nuclear material (SNM) such as plutonium. Monte Carlo calculations were used to optimize the design of the 15-cm-deep x 122-cm-high x 244-cm-long detector chambers, which utilize /sup 3/He proportional counters inside a hollow polyethylene box. Results for a variety of parametric studies, including polyethylene thickness and detector number, are described. The experimental measurements are in good agreement with the computer calculations. The monitor's decision logic uses the Sequential Probability Ratio Test (SPRT) on Poisson distributed counting data, which is superior to other statistical tests in many applications. We performed computer simulations of the SPRT logic to determine expected false-positive decision rates. A controller unit of our design that uses this SPRT was built commercially. The cost of the complete monitoring system is similar to that of vehicle portal monitors that detect gamma rays. This new neutron monitor can serve as an addition to standard gamma-ray vehicle portals or as a stand-alone portal monitor in particular safeguards monitoring situations. The monitor is being tested at Los Alamos and is scheduled for in-plant evaluation at another DOE facility in 1987.

11095 **New portable hand-held radiation instruments for measurements and monitoring.** Fehlau, P.E. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 448-453(Jul 1987). (CONF-870713—).

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Hand-held radiation monitors are often used to search pedestrians and motor vehicles for special nuclear material (SNM) as part of a physical protection plan for nuclear materials. Recently, the Los Alamos Advanced Nuclear Technology group has commercialized an improved hand-held monitor that can be used for both physical-protection monitoring and verification measurements in nuclear material control and waste management. The new monitoring instruments are smaller and lighter; operate much longer on a battery charge; are available with NaI(Tiota) or neutron and gamma-ray sensitive plastic scintillation detectors; and are less expensive than other comparable instruments. They also have a second operating mode for making precise measurements over counting times as long as 99 s. This mode permits making basic verification measurements that may be needed before transporting nuclear material or waste outside protected areas. Improved verification measurements can be made with a second new hand-held instrument that has a stabilized detector and three separate gamma-ray energy windows to obtain spectral information for SNM quantity, enrichment, or material-type verification.

11096 **A performance evaluation of personnel identity verifiers.** Maxwell, R.L.; Wright, L.J. (Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* **16**: 417-423(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

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Personnel identity verification devices, which are based on the examination and assessment of a body feature or a unique repeatable personal action, are steadily improving. These biometric devices are becoming more practical with respect to accuracy, speed, user compatibility, reliability and cost, but more development is necessary to satisfy the varied and sometimes ill-defined

future requirements of the security industry. In an attempt to maintain an awareness of the availability and the capabilities of identity verifiers for the DOE security community, Sandia Laboratories continues to comparatively evaluate the capabilities and improvements of developing devices. An evaluation of several recently available verifiers is discussed in this paper. Operating environments and procedures more typical of physical access control use can reveal performance substantially different from the basic laboratory tests.

11097 **Preliminary field evaluation of solid state cameras for security applications.** Murray, D.W. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 618-625(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

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Recent developments in solid state imager technology have resulted in a series of compact, lightweight, all-solid-state closed circuit television (CCTV) cameras. Although it is widely known that the various solid state cameras have less light sensitivity and lower resolution than their vacuum tube counterparts, the potential for having a much longer Mean Time Between Failure (MTBF) for the all-solid-state cameras is generating considerable interest within the security community. Questions have been raised as to whether the newest and best of the solid state cameras are a viable alternative to the high maintenance vacuum tube cameras in exterior security applications. To help answer these questions, a series of tests were performed by Sandia National Laboratories at various test sites and under several lighting conditions. The results of these tests as well as a description of the test equipment, test sites, and procedures are presented in this report.

11098 **The evolution of interior intrusion detection technology at Sandia National Laboratories.** Graham, R.H.; Workhoven, R.M. (Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* 16: 595-601(Jul 1987). (CONF-870713—).

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Interior Intrusion Detection Technology began at Sandia National Laboratories (SNL) in 1975 as part of the Fixed Facilities Physical Protection Research and Development program sponsored by the U.S. Department of Energy in connection with their nuclear safeguards effort. This paper describes the evolution of Interior Intrusion Detection Technology at Sandia National Laboratories from the beginning of the Interior Sensor Laboratory to the present. This Laboratory was established in 1976 to evaluate commercial interior intrusion sensors and to assist in site-specific intrusion detection system designs. Examples of special test techniques and new test equipment that were developed at the Lab are presented, including the Sandia Intruder Motion Simulator (SIMS), the Sensor and Environment Monitor (SEM), and the Sandia Interior Robot (SIR). The authors also discuss new sensors and unique sensor combinations developed when commercial sensors were unavailable and the future application of expert systems.

11099 **A microprocessor interface for an electronic seal/video surveillance system.** Richter, B.; Stein, G.; Johnson, C.S.; Sonnier, C.S. (Kernforschungsanlage Julich GmbH, D-5170 Julich). *Journal of Nuclear Materials Management;* 16: 592-594(Jul 1987). (CONF-870713—).

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In international nuclear materials safeguards a need for advanced containment/surveillance equipment is anticipated which uses electronic sealing and closed circuit television in a coupled system approach. The paper describes a microprocessor interface for a seal/TV surveillance system, which is being developed within the framework of the bilateral exchange program between the U.S.A. and the Federal Republic of Germany. In its basic form, this interface would provide recorded video data of the application and/or removal of the electronic seal, together with annotated video frames containing pertinent seal data. Possible applications are discussed.

11100 **Semi-automated reviewing station for IAEA optical surveillance data.** Darnell, R.A.; Sonnier, C.S. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 579-584(Jul 1987). (CONF-870713—).

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A study is underway on the use of computer vision technology to assist in visual inspection of optical surveillance data. The IAEA currently uses optical surveillance as one of its principle Containment and Surveillance (C/S) measures. The review process is a very time-consuming and tedious task, due to the large amount of optical surveillance data to be reviewed. For some time, the IAEA has identified as one of its principle needs an automated optical surveillance data reviewing station that assists the reviewer in identifying activities of safeguards interest, such as the movement of a very large spent fuel cask. The present development reviewing station consists of commercially available digital image processing hardware controlled by a personal computer. The areas under study include change detection, target discrimination, tracking, and classification. Several algorithms are being evaluated in each of these areas using recorded video tape of safeguards relevant scenes. The computer vision techniques and current status of the studies are discussed.

11101 **The modular integrated video system (MIVS).** Schneider, S.L.; Sonnier, C.S. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 565-566(Jul 1987). (CONF-870713—).

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The Modular Integrated Video System (MIVS) is being developed for the International Atomic Energy Agency (IAEA) for use in facilities where mains power is available and the separation of the Camera and Recording Control Unit is desirable. The system is being developed under the US Program for Technical Assistance to the IAEA Safeguards (POTAS). The MIVS is designed to be a user-friendly system, allowing operation with minimal effort and training. The system software, through the use of a Liquid Crystal Display (LCD) and four soft keys, leads the inspector through the setup procedures to accomplish the intended surveillance or maintenance task. Review of surveillance data is accomplished with the use of a Portable Review Station. This Review Station will aid the inspector in the review process and determine the number of missed video scenes during a surveillance period.

11102 **A video authentication technique.** Johnson, C.S. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 567-569(Jul 1987). (CONF-870713—).

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Unattended video surveillance systems are particularly vulnerable to the substitution of false video images into the cable that connects the camera to the video recorder. New technology has made it practical to insert a solid state video memory into the video cable, freeze a video image from the camera, and hold this image as long as desired. Various techniques, such as line supervision and sync detection, have been used to detect video cable tampering. The video authentication technique described in this paper uses the actual video image from the camera as the basis for detecting any image substitution made during the transmission of the video image to the recorder. The technique, designed for unattended video systems, can be used for any video transmission system where a two-way digital data link can be established. The technique uses similar microprocessor circuitry at the video camera and at the video recorder to select sample points in the video image for comparison. The gray scale value of these points is compared at the recorder controller and if the values agree within limits, the image is authenticated. If a significantly different image was substituted, the comparison would fail at a number of points and the video image would not be authenticated. The video authentication system can run as a stand-alone system or at the request of another system.

11103 Computer security inspection: An inspectee perspective. Penny, S.K.; Caldwell, R.J. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* **16**: 548-550(Jul 1987). (CONF-870713—).

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The inspection process within the Department of Energy (DOE) is intended to be an independent monitor and reporter of the status of security programs in various areas, such as computer security. It is one of several quality controls on the security process within the DOE's structure. When it works well, it contributes to a standard of performance for security across DOE sites. When it works badly, it results in embarrassment to DOE and potentially contributes to a misalignment of priorities. When the process works well, the site describes how its security controls function within the organization and mission of the site for the purpose of external analysis and verification. The Standards and Criteria represent a compromise between Headquarters and the DOE field organizations regarding issues and priorities to be reviewed and serve as a mutual basis in preparing for and conducting an inspection. The result is an independent analysis that can be factored into the local decision process. The paper discusses this interaction. The process becomes dangerous if its results are taken out of context. This happens if the results are prematurely released outside of DOE and receive national or congressional attention prior to their internal adjudication. Another danger exists of reacting to findings rather than using them to find solutions.. When this happens, a misalignment of priorities and expenditures frequently occurs. This paper discusses these dangers and ways to avoid them.

11104 OSE inspection of protection program operations field perspective of inspections. Brown, R.W.; Martin, H.R. (D.O.E. Idaho Operations Office, Idaho Falls, ID 83402). *Journal of Nuclear Materials Management;* **16**: 542-543(Jul 1987). (CONF-870713—).

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Protection Program Operations includes three functional areas: Physical Protection Systems, Protective Forces, and System Performance Testing. The Office of Security Evaluations (OSE) inspects field offices in these areas by evaluating programs relative to Standards and Criteria and by performing a variety of exercises and other types of tests to assure protective systems are effective and maintained at a proper level to meet the defined threat. Their perception of the OSE inspections has been positive. The approach taken by ID, with key areas/activities emphasized, during each phase of the field inspection process is described in this report. The most important areas for field offices to concentrate are: inspection preparations through self-evaluation, improving communications, assigning knowledgeable trusted agents, increasing awareness of facility procedures and operations, and assuring daily validations of inspected areas. Emphasis is placed on striving for a balance in reporting both positive and negative findings, and for consistency between ratings and the importance of report findings. OSE efforts to develop improved rating methodologies are encouraged.

11105 The New Brunswick Laboratory Safeguards Measurement Evaluation Program. Cacic, C.G.; Trahey, N.M.; Zook, A.C. (U.S. DOE New Brunswick Lab., 9800 South Cass Avenue, Bldg. 350, Argonne, IL 60439). *Journal of Nuclear Materials Management;* **16**: 511-520(Jul 1987). (CONF-870713—).

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The New Brunswick Laboratory (NBL) has been tasked by the U.S. Department of Energy (DOE) Office of Safeguards and Security (OSS) to assess and evaluate the adequacy of measurement technology as applied to materials accounting in DOE nuclear facilities. The Safeguards Measurement Evaluation (SME) Program was developed as a means to monitor and evaluate the quality and effectiveness of accounting measurements by site, material balance area (MBA), or unit process. Phase I of the SME Program, initiated during 1985, involved evaluation of the primary accountability measurement methods at six DOE Defense Programs facilities: Savannah River Plant, Portsmouth Gaseous Diffusion Plant, Y-12 Plant, Rocky Flats Plant, Rockwell Hanford Operations, and NBL. Samples of uranyl nitrate solution, dried plutonium nitrates, and plutonium oxides were shipped to the participants for assay and isotopic abundance measurements. Resulting data are presented and evaluated as indicators of current state-of-the-practice accountability measurement methodology, deficiencies in materials accounting practices, and areas for possible assistance in upgrading measurement capabilities. Continuing expansion of the SME Program to include materials which are representative of specific accountability measurement points within the DOE complex is discussed.

11106 Present and future aspects of PROSA - A computer program for near real time accountancy. Beedgen, R. (Kernforschungszentrum Karlsruhe, Institut fuer Datenverarbeitung in der Technik, D-7500 Karlsruhe). *Journal of Nuclear Materials Management;* **16**: 499-504(Jul 1987). (CONF-870713—).

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The methods of near real time accountancy (NRTA) for safeguarding nuclear material received a lot of attention in the last years. They developed PROSA 1.0 as a computer program to evaluate a sequence of material balance data based on three statistical tests for a selected false alarm probability. A new NRTA test procedure will be included and an option for the calculation of detection probabilities of hypothetical loss patterns will be made available in future releases of PROSA. Under a non-loss assumption, PROSA may also be used for the analysis of facility measurement models.

11107 A safeguards verification technique for solution homogeneity and volume measurements in process tanks. Suda, S.; Franssen, F. (Brookhaven National Lab., Upton, NY 11973). *Journal of Nuclear Materials Management;* **16**: 760-765(Jul 1987). (CONF-870713—). Contract AC02-76CH00016.

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A safeguards verification technique is being developed for determining whether process-liquid homogeneity has been achieved in process tanks and for authenticating volume-measurement algorithms involving temperature corrections. It is proposed that, in new designs for bulk-handling plants employing automated process lines, bubbler probes and thermocouples be installed at several heights in key accountability tanks. High-accuracy measurements of density using an electromanometer can now be made which match or even exceed analytical-laboratory accuracies. Together with regional determination of tank temperatures, these measurements provide density, liquid-column weight and temperature gradients over the fill range of the tank that can be used to ascertain when the tank solution has reached equilibrium. Temperature-correction algorithms can be authenticated by comparing the volumes obtained from the several bubbler-probe liquid-height measurements, each based on different amounts of liquid above and below the probe. The verification technique is based on the automated electromanometer system developed by Brookhaven National Laboratory (BNL). The IAEA has recently approved the purchase of a stainless-steel tank equipped with multiple bubbler and thermocouple probes for installation in its Bulk Calibration Laboratory at IAEA Headquarters, Vienna. The verification technique is scheduled for preliminary trials in late 1987.

11108 Cerenkov glow observations from spent fuel. Skalyo, J. Jr. (Brookhaven National Lab., Upton, NY 11973). *Journal of Nuclear Materials Management;* **16**: 741-745(Jul 1987). (CONF-870713—).

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The observation of Cerenkov glow from a fuel assembly is an attractive method of detecting the presence of radioactive material. The simple, hand-held instrumentation is very easy to use and does not require penetration of the water in the spent fuel pool. An obstacle to routine use of the instrument arises in that the standard night vision devices have a broad band wavelength response which required the pool area to be darkened. Various techniques used to limit the bandwidth of the devices for use in viewing the Cerenkov glow in the presence of facility illumination have furthered imple-

mentation. A properly specified, commercially available instrument has been used to make narrow band observations at two power reactors without interference from the facility illumination. Problems of interpretation of the observations persist. The technique has no useful role to play in the verification of an assembly at the rod level. As an item, the assembly can be verified as containing radioactive material in many instances; however some ambiguous situations were encountered.

11109 **Development of a 20-ton-capacity load-cell-based weighing system for IAEA field use.** Cooley, J.N.; Huxford, T.J. (International Technology Programs, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* **16**: 730-734(Jul 1987). (CONF-870713—). Contract AC05-84OR21400.

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Based on results of an International Atomic Energy Agency (IAEA) field test of the prototype 20-ton-capacity Load-Cell-Based Weighing System (LCBWS), a modified LCBWS is being configured for routine IAEA field use in verifying the masses of 10- and 14-ton UF/sub 6/ cylinders. The modified system is being designed to meet IAEA objectives for accuracy and portability as well as to meet facility operating safety conditions. To best meet these design requirements, a comprehensive survey of commercially available weighing equipment was conducted. Detailed equipment specifications for 25 load cells from 15 manufacturers, for 5 digital crane scales from 3 manufacturers, and for 7 digital weight indicators from 5 manufacturers were compared. The recommended system configuration is a custom-designed load cell in conjunction with a production digital weight indicator. Safety certification of the system by an internationally recognized verification authority is also recommended. Comparison criteria and their effect on the LCBWS design requirements are discussed, and the status of the project is reported.

11110 **Independent fissile inventory verification in a large tank employing lutetium double spikes.** Carter, J.A.; Walker, R.L.; May, M.P.; Smith, D.H.; Hebble, T.L. (Oak Ridge National Lab., Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* **16**: 689-691(Jul 1987). (CONF-870713—). Contract AC05-84OR21400.

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A 3000-liter feed adjustment tank containing over 2400 L of uranium solution was assayed for its contents using the double spiking technique of isotope dilution mass spectrometry. Lutetium was the double spike, with the natural element used as the initial spike and enriched 176-Lu as the second. The ability of a remote sampling system was evaluated for its ability to introduce the lutetium and also to produce homogeneous sample solutions. The system was found to be satisfactory. Volumes of the tank can be measured to a precision of about 0.2%. The concentration of uranium was measured as 154.5 g/L uranium, thus giving a total of 382.3 kg in the tank as compared to the plant's best estimate of 383 kg. Uranium measurements were subjected to internal calibration calculations, with 233-U and 236-U being used as the reference isotopes. A diversion of 5% of the tank contents was simulated to evaluate the method's sensitivity in this regard. The ability of this method to give timely results of good precision makes it a strong candidate for use in material balance and inventory accountability applications; it also has potential use in quality assurance areas.

11111 **Determining concentration inhomogeneity inside liquid holding tanks.** Sprouse, K.M.; Nealy, C.L.; Turner, T.N. (Rocketdyne Div., Rockwell International, Canoga Park, CA 91303). *Journal of Nuclear Materials Management;* **16**: 684-688(Jul 1987). (CONF-870713—).

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Incorporating concentration measurements of special nuclear material (SNM) in a chemical processing accountability program requires uncertainty data for three types of errors: mixing, sampling, and analytical. Usually, the analytical measurement uncertainties - both random and systematic - are routinely determined for the laboratory instrumentr and procedures being used to measure the concentration of withdrawn liquid samples. However, little data currently exists to determine how representative the withdrawn liquid sample is in relation to the true average bulk concentration within the tank itself. This sample representativeness depends upon uncertainties associated with the tank mixing and sampling procedures. Both types of uncertainties are investigated. Mixing uncertainty or inhomogeneity has been found to be primarily a fluid mechanics problem while sampling uncertainty involves mostly chemistry. Experimental results are presented along with the early developments of a scaling analysis for future process design and accountability work. Tests were performed on full size pencil, double pencil, and annular tanks using saltwater solutions to achieve various levels of density stratifications within the tanks analogous to nitric acids solutions of different normalities.

11112 **Controlled, economical and reliable volume measurement system for the laboratory.** Clark, J.P.; Maxwell, S.L. III. (E.I. du Pont de Nemours and Co., Savannah River Plant, Aiken, SC 29801). *Journal of Nuclear Materials Management;* **16**: 678-683(Jul 1987). (CONF-870713—). Contract AC09-76SR00001.

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Volume measurements are the most common measurements in the analytical laboratory and hence often receive minimal attention. At the Savannah River Plant (SRP), major changes in pipeting techniques and equipment were made that have reduced equipment costs by over $1,000,000 since 1982 and have cut pipeting and radiation exposure time by at least 50%. Extensive statistical studies were made to assure that the quality of volumetric measurements was not compromised by the changes. The paper will discuss: the former program which used glass micropipets for accountability measurements and air displacement pipetors (ADP) with disposable tips for routine measurements; the experiments which revealed half the error associated with ADPs was due to equipment and half to operators; studies which provided information to reduce both types of error; a training program for pipet operators and a calibration program for adjustable ADPs; and the volumetric measurements control program which uses automated equipment and software to facilitate periodic calibration checks and/or recalibration of over 250 adjustable ADPs being used in one SRP laboratory.

11113 **A portable, automated, inexpensive mass and balance calibration system.** Maxwell, S.L. III; Clark, J.P. (E.I. du Pont de Nemours and Co., Savannah River Plant, Aiken, SC 29808). *Journal of Nuclear Materials Management;* **16**: 670-677(Jul 1987). (CONF-870713—). Contract AC09-76SR00001.

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Reliable mass measurements are essential for a nuclear production facility or process control laboratory. DOE Order 5630.2 requires that traceable standards be used to calibrate and monitor equipment used for nuclear material measurements. To ensure the reliability of mass measurements and to comply with DOE traceability requirements, a portable, automated mass and balance calibration system is used at the Savannah River Plant. Automation is achieved using an EPSON HX-20 notebook computer, which can be operated via RS232C interfacing to electronic balances or function with manual data entry if computer interfacing is not feasible. This economical, comprehensive, user-friendly system has three main functions in a mass measurement control program (MMCP): balance certification, calibration of mass standards, and daily measurement of traceable standards. The balance certification program tests for accuracy, precision, sensitivity, linearity, and cornerloading versus specific requirements. The mass calibration program allows rapid calibration of inexpensive mass standards traceable to certified Class S standards. This MMCP permits daily measurement of traceable standards to monitor the reliability of balances during routine use. The automated system verifies balance calibration, stores results for future use, and provides a printed control chart of the stored data. Another feature of the system permits three different weighing routines that accommodate their need for varying degrees of reliability in routine weighing operations.

11114 **A humidity temperature test on the HLNC instrument.** Goldman, A.; Augustson, R.; Karlin, E.W. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* 16: 666-669(Jul 1987). (CONF-870713—).

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This paper presents the findings of a laboratory study made to determine the effects of unusual climatic conditions on high-level neutron coincidence counters (HLNCs). The authors examine the capability of the instrument when undesirable temperatures and/or humidities are present, the change in count rate as temperature and humidity increase, and the extent of humidity/temperature interaction.

11115 **A nondestructive assay standards program at the Savannah River Plant.** Studley, R.V. (E.I. Du Pont De Nemours Co., Inc., Savannah River Plant, Aiken, SC 29808). *Journal of Nuclear Materials Management;* 16: 661-665(Jul 1987). (CONF-870713—). Contract AC09-76SR00001.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

To minimize accountability inventory differences, high accuracy standards are needed to complement recently developed high precision NDA instruments. A program to acquire specific material standards having the highest achievable accuracy was developed and successfully completed. The goal for this program was to define performance of NDA systems to at least 0.1% +- 1σ accuracy. Among sixteen standards that were evaluated, relative standard deviations from traceable values were better than 0.042%. This was a significant achievement by the four participating analytical laboratories, particularly analytical laboratories, particularly considering dissolution difficulties of some of the materials. Value of this level of accuracy is significant since some NDA equipment installed in the process has achieved precision better than +-0.1% +-σ of full range. These instruments with forecast good long-term stability and the high accuracy standards should significantly reduce ID's that would have resulted if current measurement techniques had been used.

11116 **SAND87-0950C: A video imaging system for detection, tracking, and assessment (VISDTA).** Pritchard, D.A. (Sandia National Labs., Systems Engineering Div. 5238, Albuquerque, NM 87185-5800). *Journal of Nuclear Materials Management;* 16: 640-644(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Automatic scene scanning and digital video processing are combined in a sensor/assessment system called VISDTA. In fixed-site or mobile security applications, the operator can initiate automatic scene scanning. While scanning, detection algorithms process video from a thermal imager or low-light camera. An additional detection algorithm operates on single fixed scenes. Video is displayed with graphics on a monitor next to the operator's touch-panel display. Assessment by the operator is aided by zoom/focus control, pan/tilt control, and range measurements. Detection ranges can be kilometers. In this paper, the system design is described, along with highlights of the user interface, and performance estimates are made.

11117 **Verification of a modular safeguards control and communication system.** Ortiz, S.; Roybal, J.A.; Quintana, G.R.; Williams, J.S. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 634-639(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

A Safeguards Control and Communication System (SCCS) has been developed for a facility based on existing modular SCCS software for another facility. The majority of FORTRAN 77 software modules were directly carried over from one SCCS to the other with only minor modifications for site-specific considerations. Therefore, savings in time and money for design, development, fabrication, and documentation were realized. Two significant hardware changes were made in the SCCS which accounted for most of the software development. The Alarm Multiplexer Communication System (AMCS) was used instead of the Loop Multiplexer Communication System (LMCS) for alarm reporting. The Tektronix M4125 color graphic system was used in place of the Advanced Electronics Design 512 color graphic system for the display of system status and information. A map editor has been written for the Tektronix M4125 which facilitates the development and modification of displays. Substitution of these systems enhanced the flexibility of the SCCS because common problems in physical protection system development are addressed.

11118 **Performance criteria for categories III and IV nuclear materials.** Bingham, C.D. (New Brunswick Lab., U.S. Dept. of Energy, Argonne, IL). *Journal of Nuclear Materials Management;* 16: 86-88(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

DOE policy requires that DOE facilities protect and control the use of nuclear materials in such a manner that national security, program continuity and the health and safety of the public are not adversely impacted. Current implementation of this policy is based largely on compliance to specified requirements. Such requirements have not addressed site-specific situations and do not provide a means to quantify how well an integrated safeguards system is achieving policy objectives. The proposed performance criteria for Categories III and IV nuclear materials which are in the early stages of development address the potential impact on public health and safety of the use of these quantities of materials. These criteria attempt to provide more clear and consistent guidance regarding graded protection than do the current orders. Details of the proposed criteria are presented from the standpoint of a laboratory facility rather than a production facility.

11119 **Enhancing the role of MC and A through performance criteria.** Emeigh, C.W.; Smith, B.W.; Ehinger, M.H. (U.S. Nuclear Regulatory Commission, Washington, DC). *Journal of Nuclear Materials Management;* 16: 92-103(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Nuclear material safeguards combines physical protection and material control and accounting (MCandA). Integration of these measures to optimize protection requires defining the role of each in the context of the potential threats. The NRC amended 10 CFR Parts 70 and 74 to reform the MCandA regulations. The Reform Amendments specify insider threats to protect against and the general goals for detection, response and assurance. The Reform Amendments use the graded safeguards concept and are performance oriented. They allow a facility flexibility in determining how to meet the goals. An element of the Reform Amendments is the use of process monitoring data to account for nuclear materials in-process. This paper reviews the evolution of the Reform Amendments and identifies some of the decisions to implement performance criteria.

11120 **The role of performance criteria.** Cathey, S.S.; Emon, D.E. (E.I. du Pont de Nemours and Co., Savannah River Plant, Aiken, SC 29801). *Journal of Nuclear Materials Management;* 16: 77-80(Jul 1987). (CONF-870713—). Contract AC09-76SR00001.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Performance criteria could play a primary role in future DOE NMCandA Orders. A performance-based system would use a combination of performance and compliance criteria to develop the DOE Order. The performance criteria concept, the benefits, the implementation, and the evaluation of a performance-based system will be discussed.

11121 **Setting priorities for safeguards upgrades.** Al-Ayat, R.A.; Judd, B.R.; Patenaude, C.J.; Sicherman, A. (Lawrence Livermore National Lab., Livermore, CA). *Journal of Nuclear Materials Management;* 16: 44-49(Jul 1987). (CONF-870713—). Contract W-7405-ENG-48.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This paper describes an analytic approach and a computer program for setting priorities among safeguards upgrades. The approach provides safeguards decision makers with a systematic method for allocating their limited upgrade resources. The priorities are set based on the upgrades cost and their contribution to safeguards effectiveness. Safeguards effectiveness is measured by the probability of defeat for a spectrum of potential insider and outsider adversaries. The computer program, MI$ER, can be used alone or as a companion to ET and SAVI, programs designed to evaluate safeguards effectiveness against insider and outsider threats, respectively. Setting the priority required judgments about the relative importance (threat likelihoods and consequences) of insider and outsider threats. Although these judgments are inherently subjective, MI$ER can analyze the sensitivity of the upgrade priorities to these weights and determine whether or not they are critical to the priority ranking. MI$ER produces tabular and graphical results for comparing benefits and identifying the most cost-effective upgrades for a given expenditure. This framework provides decision makers with an explicit and consistent analysis to support their upgrades decisions and to allocate the safeguards resources in a cost-effective manner.

11122 **The SAVI vulnerability assessment model.** Winblad, A.E. (Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* **16**: 24-28(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The assessment model "Systematic Analysis of Vulnerability to Intrusion" (SAVI) presented in this report is a PC-based path analysis model. It can provide estimates of protection system effectiveness (or vulnerability) against a spectrum of outsider threats including collusion with an insider adversary. It calculates one measure of system effectiveness, the probability of interruption P(I), for all potential adversary paths. SAVI can perform both theft and sabotage vulnerability analyses. For theft, the analysis is based on the assumption that adversaries should be interrupted either before they can accomplish removal of the target material from its normal location or removal from the site boundary. For sabotage, the analysis is based on the assumption that adversaries should be interrupted before completion of their sabotage task.

11123 **The R and D/operational MC and A interface.** Shipley, J.P. (Los Alamos National Lab., Los Alamos, NM). *Journal of Nuclear Materials Management;* **16**: 216-220(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Improvements in our ability to do materials control and accounting (MCandA) have been steady since the beginning of the nuclear age and the appearance of processes and facilities for handling nuclear materials. The motivation for these improvements has not been just safeguards: the desire for better process control also has played a major role, and the emergence of technology focused on the problems of MCandA has made it possible to pursue such improvements. However, it is a continuing challenge to match the needs of the operational MCandA elements with the capabilities and resources of the RandD community. In the last couple of years this challenge has been addressed very visibly by the DOE's Project Cerberus RandD Committee, which has devised a procedure to encourage closer interactions between the operations and RandD elements. In the particular case of Los Alamos, we have recently concluded the efforts of the Nuclear Materials Management and Safeguards Task Force, which made strong recommendations about the need for close internal cooperation. The issues associated with these activities and the specific means for addressing them, will be of surpassing interest for the future of safeguards.

11124 **Office of Safeguards and Security - Operational Interface.** Hammond, G.A. (U.S. Dept. of Energy, Washington, DC 20545). *Journal of Nuclear Materials Management;* **16**: 212-215(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The mission of the Office of Safeguards and Security (OSS), Department of Energy (DOE) is to: Develop policy and programs to protect DOE facilities, nuclear materials, and classified information; Provide oversight for safeguards and security operations; Direct research and development (RandD) to support the protection program; and Strengthen international safeguards in support of nonproliferation policy. Objectives are to maintain an integrated safeguards and security system that is effective against a wide range of threats, and do so in a manner to minimize impacts on facility operation. Implementation is the responsibility of field offices and contractors operating DOE facilities. The OSS-operational interface is the focus of this discussion with emphasis on RandD to meet user needs. The scope and project selection process will be discussed along with information required for evaluation, and field operational planning and budgeting commitments to permit implementation of successful RandD results.

11125 **On assessing the insider threat potential.** Lim, J.J. (Lim and Orzechowski Associates, Livermore, CA). *Journal of Nuclear Materials Management;* **16**: 174-180(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Most security practitioners are reluctant to try to assess the Insider Threat because of the lack of a valid database for this threat. Yet, nuclear facilities are obligated to determine the effectiveness of their safeguards systems against the Insider Threat and are sometimes required by various government agencies to estimate site risk measures for this threat. This paper presents a methodology for quantifying a topic that resists quantification. Three distinct steps are involved in the methodology for assessing the Insider Threat potential: 1. Characterize the types of insiders who might potentially harm the organization, with emphasis on scientific and engineering facilities; 2. Identify and assess elements in the organization's Personnel Reliability Program that can reduce the chances of the Insider Threat potential being realized; and 3. Apply an event tree methodology that uses the above surrogate data to evaluate the site-specific Insider threat potential. In addition to presenting a methodology for quantifying the Insider Threat potential, the paper also gives some basic conclusions on preventing insider malevolence that are drawn from analyses of insider cases and expert opinion.

11126 **Tactical Vulnerability Assessment Training Program.** Al-Ayat, R.A.; Judd, B.R.; Renis, T.A.; Paulus, W.K.; Winblad, A.G.; Graves, B.R. (Lawrence Livermore National Lab.). *Journal of Nuclear Materials Management;* **16**: 169-173(Jul 1987). (CONF-870713—). Contract W-7405-ENG-48.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Department of Energy sponsors a 9-day training program for individuals who are responsible for evaluating and planning safeguards systems and for preparing DOE Master and Security Agreements (MSSAs). These agreements between DOE headquarters and operations offices establish required levels of protection. The curriculum includes: (1) the nature of potential insider and outsider threats involving theft or diversion of special nuclear material, (2) use of computerized tools for evaluating the effectiveness of physical protection and material control and accountability systems, and (3) methods for analyzing the benefits and costs of safeguards improvements and for setting priorities among proposed upgrades. The training program is varied and high interactive. Presentations are intermixed with class discussions and "hands-on" analysis using computer tools. At the end of the program, participants demonstrate what they have learned in a two-and-one-half day "field exercise," which is conducted on a facility scale-model. The training program has been conducted six times and has been attended by representatives of all DOE facilities. Additional sessions are planned at four-month intervals. This paper describes the training program, use of the tools in preparing MSSAs for various DOE sites, and recent extensions and refinements of the evaluation tools.

11127 **An interactive videodisc system for training.** Cadwell, J.J. (Brookhaven National Lab., Upton, NY 11973). *Journal of Nuclear Materials Management;* **16**: 286-289(Jul 1987). (CONF-870713—). Contract AC02-76CH00016.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Under the sponsorship of the U.S. Department of Energy's Office of Classification (DOE/OC), Brookhaven National Laboratory/Technical Support Organization (BNL/TSO) has prepared a level-three interactive-laserdisc program for the training of authorized classifiers in the Department of Energy. This training programs consists of six modules presented in several formats. The material is presented in a highly interactive manner with various tests to reinforce and evaluate the trainee's progress in learning the material. A lengthy qualification test is presented at the end of the educational material. The various instructional techniques of scenario presentation, "talking heads", graphics, textual material and combinations of the above are used to assure that the training material attracts the trainee's interests and motivates him to understand and use the material. The state-of-the-art interactive laser videodisc with its storage capacity, speed flexibility, and superior training capacity was the logical choice for the training of Authorized Classifiers in the Department of Energy.

11128 **Inventory differences: An evaluation methodology.** Heinberg, C.L.; Roberts, N.J. (Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* **16**: 238-242(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This paper discusses an evaluation methodology which is used for inventory differences at the Los Alamos National Laboratory. It is recognized that there are various methods which can be, and are being, used to evaluate process inventory differences at DOE facilities. The purpose of this paper is to share our thoughts on the subject and our techniques with those who are responsible for the evaluation or inventory differences at their facility. The authors feel that one of the most dangerous aspects of any evaluation technique, especially one as complex as most inventory difference evaluations tend to be, is to fail to look at the tools being used as indicators. There is a tendency to look at the results of an evaluation by one technique as an absolute. At the Los Alamos National Laboratory, several tools are used and the final evaluation is based on a combination of the observed results of a many-faceted evaluation. The tools used and some examples are presented.

11129 **The MBA custodian - Has this safeguards program element been neglected.** Byers, K.R. (Battelle Pacific Northwest Labs., P.O. Box 999, Richland, WA 99352). *Journal of Nuclear Materials Management;* **16**: 234-237(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The nuclear material programs at U.S. facilities are comprised of physical security systems, material control and accountability (MCandA) systems, and safeguards personnel. Considerable attention has been given to upgrading physical security components and MCandA equipment and practices, but how much emphasis has been placed on acquiring the right people for the job, determining what they need to know and how they should be trained, and evaluating their performance on a continual basis? Without dedicated and qualified personnel, both physical security and MCandA effectiveness suffer. The objectives of this paper are to highlight the SNM custodial requirements at DOE facilities; identify documentation required for the development and implementation of a training program; provide insight into custodian performance evaluations; and identify areas where additional program guidance is needed. Are adequate guidelines established to assure that federal requirements result in a uniform knowledge base for all custodians? This paper addresses this issue and asks if we are ready to fully test custodian performance.

11130 **The nuclear materials control and accountability internal audit program at the Oak Ridge Y-12 plant.** Lewis, T.J. (Oak Ridge Y-12 Plant, Martin Marietta Energy Systems, Inc., Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* **16**: 231-233(Jul 1987). (CONF-870713—). Contract AC05-84OR21400.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The internal audit program of the Nuclear Material Control and Accountability (NMCandA) Department at the Oak Ridge Y-12 Plant, through inventory-verification audits, inventory-observation audits, procedures audits, and records audits, evaluates the adequacy of material accounting and control systems and procedures throughout the Plant; appraises and verifies the accuracy and reliability of accountability records and reports; assures the consistent application of generally accepted accounting principles in accounting for nuclear materials; and assures compliance with the Department of Energy (DOE) and NMCandA procedures and requirements. The internal audit program has significantly strengthened the control and accountability of nuclear materials through improving the system of internal control over nuclear materials, increasing the awareness of materials control and accountability concerns within the Plant's material balance areas (MBAs), strengthening the existence of audit trails within the overall accounting system for nuclear materials, improving the accuracy and timeliness of data submitted to the nuclear materials accountability system, auditing the NMCandA accounting system to ensure its accuracy and reliability, and ensuring that all components of that system (general ledgers, subsidiary ledgers, inventory listings, etc.) are in agreement among themselves.

11131 **Nuclear safeguards surveys as performed by the Albuquerque operations office.** Jewell, D. (U.S. Dept. of Energy, Albuquerque, NM). *Journal of Nuclear Materials Management;* **16**: 228-230(Jul 1987). (CONF-870713—).

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The nuclear safeguards survey program as administered by the Albuquerque Operations Office (AL) is comprehensive in scope and evaluates the facility's safeguards program for an entire appraisal period. The survey program focuses on both the integrated and graded safeguards concepts and includes both compliance and performance evaluations. The program utilizes independent measurement support to verify facility inventory values and measurement system capabilities. The AL survey program is oriented towards facility development and management as opposed to development and management by numerous detailed departmental directives.

11132 **Where do the nuclear materials management functions fit in the materials control and accountability (MC and A) plan.** De Ver, E.A. (Los Alamos National Lab., Los Alamos, NM). *Journal of Nuclear Materials Management;* **16**: 225-227(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Safeguards had its beginning in the early 1940s and has continued to grow through the stormy years in dealing with nuclear materials. MCandA Plans have been developed for each facility which includes requirements for containment, surveillance, internal controls, measurements, statistics, records and report systems, and inventory certification of its nuclear materials, in the context of how precisely the inventory is known at stated risk or confidence levels. The I and E Regulations, the newest document affecting the control system, are used for testing the current MCandA Plan in place at each facility. Nuclear Materials Management activities also have reporting requirements that include, (1) Annual Forecast, (2) Materials Management Plan, (3) Quarterly Status Report, (4) Assessment Report, and (5) Scrap and Excess Material Management. Data used to generate reports for both functions come from the same data base and source documents at most facilities. The separation of sponsoring groups at the DOE for NM Accountability and NM Management can and does pose problems for contractors. In this paper, we will try to separate and identify these overlaps at the Facility and DOE level.

11133 **Systems analysis for materials control and accountancy technology.** Daly, T.A.; Bucher, R.G.; Rothman, A.B.; Charak, I.; Persiani, P.J. (Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL 60439). *Journal of Nuclear Materials Management;* **16**: 221-224(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The objective is to upgrade Materials Control and Accountancy (MCandA) technology over the flows of special nuclear mate-

rials throughout the DOE complex of fuel cycles. The program focus is to develop a "Management Tool" for decision support in evaluating MCandA upgrades, and invalidating the MCandA aspects of the Master Safeguards and Security Agreements (MSSA) effectiveness. The approach is the computerization of the nuclear materials flow charts, identification of key measurement locations in the production and product fuel cycle, and construct data information processing at each measurement location. The program is to provide the Office of Safeguards and Security (OSS) with a timely management decision support system in planning MCandA safeguards technology upgrades over the nuclear materials production and product cycles.

11134 **OSE inspections: A different perspective.** Ware, J.H. (U.S. Dept. of Energy, Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* 16: 551-552(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Office of Security Evaluation (OSE) is a staff activity of the Assistant Secretary for Defense Programs (ASDP) and is responsible for the conduct of an inspection and evaluation program. The OSE Inspection Division conducts assessments of the effectiveness of Department of Energy (DOE) Safeguards and Security policies and protection programs. The inspections are conducted by OSE Inspectors and Support Specialists. Prior to the author's participation in the inspection of the San Francisco Operations Office, a DOE Field Office employee had never played an active role in an OSE Inspection of another field office. This paper discloses his experience as an OSE Inspector.

11135 **OSE inspection of materials control and accountability: Field perspective of inspections.** Roberts, N.J. (Safeguards Assurance Coordinator, Los Alamos National Lab., Los Alamos, NM 87545). *Journal of Nuclear Materials Management;* 16: 535-537(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Inspection and Evaluation (I and E) process for materials control and accountability (MC and A) is discussed from the perspective of an "inspectee." Methods of preparing for a visit by the I and E team and the operational and budget impacts of the I and E Standards and Criteria are briefly discussed. The I and E process does not have to be traumatic, but it can be if the inspectee is not properly prepared and if ground rules and procedures have not been established. This paper presents the author's views and reflects his perspectives of the Office of Security Evaluations (OSE) MC and A process. In preparation for this paper, the author has talked at length with his peers and has included some of their perceptions of the I and E process. However, this paper is the sole responsibility of the author and does not constitute an official position of the Los Alamos National Laboratory or of any other entity.

11136 **OSE inspection of materials control and accountability: Review.** Coady, K.J. (U.S. Dept. of Energy, Washington, DC 20545). *Journal of Nuclear Materials Management;* 16: 531-534(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

As part of its task to confirm that Department of Energy (DOE) field offices provide levels of security and safeguards commensurate with defined threats, the DOE Office of Security Evaluations (OSE) conducts inspections of the nuclear materials control and accountability (MC and A) systems at DOE facilities throughout the United States. Inspections are based on the DOE Safeguards and Security Standards and Criteria, tailored to the specific aspects at and threats to each individual site. This paper reviews the process of inspecting MC and A systems during the planning, preinspection, and inspection/reporting phases.

11137 **Update of the OSE inspection program.** Tubbs, D.C. (U.S. Dept. of Energy, Washington, DC). *Journal of Nuclear Materials Management;* 16: 527-530(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The U.S. Department of Energy's Office of Security Evaluations (OSE) is responsible for inspecting and evaluating safeguards and security measures at Department of Energy facilities. During the past year, OSE has implemented significant organizational and procedural changes that are of interest to the safeguards and security community. This paper describes these changes in the inspection program and their current and projected impacts on efforts to maintain effective and dynamic protection programs throughout the Department of Energy.

11138 **Statistical sampling techniques as applied to OSE inspections.** Davis, J.J.; Cote, R.W. (Battelle for U.S. DOE Office of Security Evaluations, Columbus, OH). *Journal of Nuclear Materials Management;* 16: 721-723(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The need has been recognized for statistically valid methods for gathering information during OSE inspections; and for interpretation of results, both from performance testing and from records reviews, interviews, etc. Battelle Columbus Division, under contract to DOE OSE has performed and is continuing to perform work in the area of statistical methodology for OSE inspections. This paper represents some of the sampling methodology currently being developed for use during OSE inspections. Topics include population definition, sample size requirements, level of confidence and practical logistical constraints associated with the conduct of an inspection based on random sampling. Sequential sampling schemes and sampling from finite populations are also discussed. The methods described are applicable to various data gathering activities, ranging from the sampling and examination of classified documents to the sampling of Protective Force security inspectors for skill testing.

11139 **The development and significance of the DOE safeguards and security standards and criteria.** Toman, J. (Lawrence Livermore National Lab., Livermore, CA). *Journal of Nuclear Materials Management;* 16: 707-715(Jul 1987). (CONF-870713—). Contract W-7405-ENG-48.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

In October 1985, the DOE Assistant Secretary for Defense Programs created a task force to develop inspection standards and criteria for Safeguards and Security. These standards and criteria (S/C) would provide the DOE Inspection and Evaluation (I and E) teams with the guidance needed to assess the security posture of DOE's nuclear and other important facilities. The Lawrence Livermore National Laboratory was designated the lead management organization for the structuring, administration, and execution of the overall task force effort and appointed the Executive Secretary. The Office of Security Evaluations (OSE) became the responsible DOE organization, and its Director assumed the role of Chairman of the Task Force Executive Committee. At its peak, the Task Force consisted of approximately 200 people who were considered to be experts in eight major topical areas. The composition of the experts was almost evenly divided between DOE and contractor employees. The collective wisdom of these experts was used in a consensus process to develop the S/C that are now published in draft form. These S/C have been used in more than ten inspections since May 1986 with much success. This paper discusses the process used to achieve the desired end result and the significance of the Task Force's accomplishments.

11140 **A safeguards risk related approach to inspection scheduling and topic selection.** Indusi, J.P. (Brookhaven National Lab., Upton, NY). *Journal of Nuclear Materials Management;* 16: 704-706(Jul 1987). (CONF-870713—). Contract AC02-76CH00016.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Scheduling facilities and selection of topics for safeguards and security inspections may be based on a relative safeguards risk ranking of the facilities under consideration. Safeguards risk is defined as a combination of the potential threat, facility vulnerability to various malevolent events, and the consequences that may occur if a malevolent event is successfully carried out. Quantification of

the vulnerability (on a relative scale) and consequences may be possible, however the probability of a particular threat is impossible to estimate. The problem has been researched and an approach has been formulated which yields a relative safeguards risk ranking for a given group of facilities, malevolent events and potential threat groups. This approach may be useful in helping to direct inspection activities to high risk operations instead of being driven by a single element such as vulnerabilities or consequences.

11141 **The use of information resource management (IRM) in support of the inspection and evaluation program for DOE/OSE.** Gubiotti, R.A.; Spencer, C. (Battelle Columbus Div., Columbus, OH 43201). *Journal of Nuclear Materials Management;* **16**: 697-703(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Department of Energy, Office of Security Evaluations (DOE/OSE) is in the process of enhancing its inspection and evaluation programs in order to improve their effectiveness. The overall goal is to enhance the ability of OSE to make positive and gradual impacts on DOE's efforts to maintain and improve security at its nuclear facilities. This goal will be met by developing inspection and evaluation procedures that provide thorough, realistic, and unbiased judgments during inspections; produce reliable and rational inspection and evaluation results; are acceptable throughout DOE; and are defensible to criticism. These inspection and evaluation procedures will eventually result in inspections that will more realistically stress the safeguards and physical security at a site based on the accepted standards for that site. Underlying the approach for developing the inspection and evaluation procedures is an information system that will be used for the Information Resource Management (IRM) required to plan, conduct, and report inspections, and to perform evaluations. In addition, the information system will be used to archive inspection and evaluation inputs as "lessons learned" examples and to provide input to training inspectors.

11142 **Evaluation Program initiative.** Rich, B.L. (Office of Security Evaluations, U.S. Dept. of Energy, Washington, DC 20545). *Journal of Nuclear Materials Management;* **16**: 692-696(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The purpose of this paper is to provide the Department of Energy's (DOE) safeguards and security community with some insights on an important management initiative by the Office of Security Evaluations (OSE). The paper will present the "what, where, who, when, and why" of a new Evaluation Program. The Evaluation Program will be comprised of a continuing series of regular and special evaluations of DOE safeguards and security programs and policies. The evaluations will be integrative and "crosscutting," i.e. will extend across DOE organizational lines. Evaluations will be offered as positive advisories to DOE managers with safeguards and security responsibilities and will not be rated. They will complement the ongoing OSE Inspection Program of inspections conducted by OSE's Inspection Division. The purpose for the evaluations is to establish an accurate and current assessment of the effectiveness and status of safeguards and security programs and policies and to provide DOE managers with required information on program and policy effectiveness.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 10946, 10962, 10972, 11119, 12521, 12678, 12681, 12682

11143 **(INIS-mf—10969) Is there an isotope on your books? Advice to receivers and liquidators on dealing with X-ray sources and X-ray equipment.** Colgan, T. (Nuclear Energy Board, Dublin (Ireland)). Jan 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700804/JAW.

The paper outlines advice to receivers and liquidators on dealing with radioactive sources and X-ray equipment. When companies go into liquidation it is important that the accountants handling the winding up are aware of the law and their responsibilities if radioactive materials are present. Guidelines are presented here which may help indicate to the accountant the likely presence of radioactive materials and the procedure which should be followed when arranging sale or disposal of these items.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

11144 (INIS-mf—11089, pp 75) **Investigations on a vacuum arc centrifuge.** Whichello, J.; Evans, P.; Paoloni, F.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights; Wollongong Univ., Australia). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

11145 **Isotope separation using tuned laser and electron beam.** Trajmar, S. (to Administrator of the National Aeronautics and Space Administration, Washington, DC). US Patent 4,704,197. 3 Nov 1987. Filed date 13 Nov 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

The method for producing and separating a stream of a selected isotope from an atomic beam containing a mixture of isotopes is described comprising the steps of: (a) producing an atomic beam containing the isotope of interest and other isotopes; (b) producing a magnetic field to broaden the energy domain of the individual magnetic sublevels of the isotope of interest and having the atomic beam passing therethrough; (c) producing a laser beam; (d) adjusting the polarization of the laser beam to further maximize the activation of only individual magnetic sublevels of the isotope of interest; (e) aiming the laser beam to strike the atomic beam within the magnetic field and traverse the path of the atomic beam; (f) producing a collimated and high intensity beam of electrons within the magnetic field aimed to strike the atomic beam; and, (g) disposing deflection means to have the atomic beam pass therethrough after being struck by the electron beam and deflect the ionized isotope from the remainder of the beam to form a separate stream composed only of the isotope of interest.

11146 **Status report on 126/sup 0/ isotope separator construction.** Chamberlin, E.P.; Balagna, J.P.; Camplan, J.; Kelley, G.M.; Bibeau, R.A.; Rios, E.L.; Stice, R.L. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 21-24(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

Two new isotope separators are being constructed at the Los Alamos National Laboratory (LANL) Isotope and Nuclear Chemistry Divsion. The system design was a joint effort between Laboratoire Rene Bernas and LANL. Design goals included constant dispersion capability with M/M+1 separation of 18 mm at M=250 amu. The separator magnets have the following parameters: rho=1460 mm, PHI=126/sup 0/, $0.42 \leq n \leq 0.585$, gap=137 mm.

11147 **Ion-optical design for an on-line mass separator at LAMPF.** Talbert, W.L. Jr.; Wollnik, H.; Geisse, C. (Los Alamos National Lab., NM, USA; Giessen Univ., Germany, F.R.). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 351-353(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A two-stage isotope separator is proposed to operate on-line with a He-jet coupled ion source installed at LAMPF. As a special feature, the design of this separator employs a preseparation stage

to remove the intense He/sup +/ component of the ion source output. This feature allows the low-intensity radioactive ion beam to be transported throughout the two separator stages, and at the same time makes possible monitoring and control of the ion source performance. A design goal is to achieve a resolving power sufficient to provide isobar separation for nuclei far from stability, especially important because of the elemental nondiscrimination obtained using the He-jet approach.

11148 **Selective photoionization of /sup 64/Cu in the presence of /sup 63,65/Cu.** Engleman, R. Jr.; Keller, R.A.; Miller, C.M.; Nogar, N.S.; Paisner, J.A. (Los Alamos National Lab., NM, USA; Lawrence Livermore National Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 448-451(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

It has been proposed that a copper crystal enriched in /sup 64/Cu relative to /sup 63/Cu would provide a source of a low-energy, monoenergetic beam of positrons, with an intensity as much as three orders of magnitude greater than unenriched sources. We have evaluated the use of resonance ionization to selectively photoionize /sup 64/Cu in the presence of the stable isotopes /sup 63/Cu and /sup 65/Cu. It appears that this method may be applied with high selectivity and relatively high efficiency using rather simple laser systems. Various aspects of this technique will be discussed.

11149 **Essentials of a rubidium-82 generator for nuclear medicine.** Yano, Yukio. (California Univ., Berkeley, USA. Donner Lab.; Lawrence Berkeley Lab., CA, USA). *Applied Radiation and Isotopes;* **38**: No. 3, 205-211(1987).

The use of generator-produced ^{82}Rb for positron emission tomography studies in clinical nuclear medicine requires a number of factors to be considered. These include ^{82}Sr availability, methods of recharging the generator with fresh ^{82}Sr, adequate elution yield of ^{82}Rb, low breakthrough of sup(82-85)Sr, simple and reliable operation of the generator, and delivery of a sterile and pyrogen free eluate of ^{82}Rb.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 12314

11150 (INIS-mf—11089, pp 62) **Plasma processing in industry.** Boswell, R.W. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

11151 (INIS-SU—431, pp 554) **Standard samples of the SOSGI-M multi-reference spectrometric γ sources.** Danilenko, V.N.; Kurenkov, N.V.; Malinin, A.B.; Matveev, S.V.; Meshcheryakov, V.G.; Stepanov, Eh.K.; Khlebnikov, V.P.; Chechneva, O.P.; Chugunkov, A.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11152 (INIS-SU—431, pp 555) **Tables of standard reference data on the parameters of radioactive decay for nuclides used for calibration of spectrometers with semiconductor detectors.** Danilenko, V.N.; Matveev, S.V.; Nedovesov, V.G.; Stepanov, Eh.K.; Trukhacheva, A.G.; Chechev, V.P.; Checheva, E.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11153 (INIS-SU—431, pp 564) **Electron yield from /sup 99/Tc and /sup 63/Ni metallic sources.** Smirnov, V.V.; Grudskij, M.Ya.; Roldugin, N.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 11630

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 11905

11154 **(EUR—10438) L'Autonome: An advanced automatic electrolyser: Final report.** Nenner, T.; Roz, B.; Roux, M. (SODETEG - RTI, 78 - Buc (France); Grenoble-1 Univ., 38 (France)). 1986. 94p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88900214/JAW.

An electrolyser working under a pressure of 4 bar at 110°C and 4 kA/m^2 was built. The stack is made of 19 cells of 0.2 m^2 active surface, obtained by a circular geometry of 0.5 m in diameter, electrolyte channels being external. Frames are made out of polysulfone. A specially developed thin asbestos diaphragm, having an electric resistance of 0.2 Ω.cm^2, is used. Catalysis is obtained with Raney nickel at the cathode and perovskite Sr/sub 0.5/ La/sub 0.5/ CoO_3 deposited on Raney nickel at the anode. Electrodes are bipolar with elastic forelectrodes designed to obtain a zero gap between them and the diaphragm. The electrolyte circulates by gas lift, all functions of start up, monitoring and emergency shut down are performed by an on line computer. The automatic operation of the electrolyser proved to be completely satisfactory. The performances of catalyzed cells was 1.95 volt, which is 100 mV over the voltage observed in the laboratory.

0802 Storage

11155 **(PB—88-853791/XAB) Hydrogen storage: storage as a gas or liquid. January 1974-November 1987 (citations from the NTIS data base). Report for January 1974-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 85p. NTISPC N01/MF N01.

Supersedes PB—86-857885.

This bibliography contains citations concerning feasibility studies and field investigations regarding the storage of hydrogen in a liquid or gaseous phase. Topics include descriptions of specific programs undertaken by various agencies and institutions, storage methods for automotive fuels, and economic aspects. Some attention is given to materials considerations for storage tanks and transport facilities. (This updated bibliography contains 170 citations, 22 of which are new entries to the previous edition.)

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 11207, 11208, 11241, 11243, 11244, 11725

11156 **(CONF-870804—46) Biofuel cycles: Economic status and cost projections.** Gaines, L.L.; Flaim, S.J.; Wallace, C.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02. Order Number DE88003017/JAW.

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

The Biofuels and Municipal Waste Technology Division of the US Department of Energy focuses on increasing the biomass available for fuel production and on integrated fuel cycles that produce liquid and gaseous fuels. This research is in contrast to most renewable energy technologies, which produce heat or electricity. This paper describes the fuel cycles under study, examines their economic status and cost goals, and addresses technically challenging areas where major improvements are required to yield cost-competitive fuel products. In general, the biofuels technologies are projected to be ready for private-sector development and commercialization in the mid- to long term. The data presented for technical and economic goals are based on current information and are subject to periodic review and revision. 5 refs., 7 tabs.

11157 **(CRIQ—532/0036) Direct conversion of synthesis gas to high octane gasoline over HZKQ-IB zeolite. Final report.** Leen, K.; Chang, J.R. (Centre de Recherche Industrielle du Quebec, Sainte-Foy (Canada)). 15 Jul 1986. 203p. (MICROLOG—87-02208). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A technical feasibility study has been conducted on the direct conversion of synthesis gas into high octane gasoline over a proprietary multi-functional crystalline ironborosilicate zeolite designated as ZKQ-IB, used either in its original hydrogen form or its chemically modified form. The methods of preparation as well as the chartacterization of the crystalline ironborosilicate zeolite are described and results obtained therefrom are discussed. In the majority of cases, both modified and unmodified zeolite displayed high synthesis gas conversions and high selectivities to gasoline. The potential applications of these crystalline ironborosilicate zeolites to the co-production of premium gasoline, diesel or jet fuel, and the upgrading of primary Fischer-Tropsch product hydrocarbons to high octane gasoline are suggested.

11158 **(DOE/ER/13386—5) Genetics in methylotrophic bacteria: Final report for period February 1, 1983-June 30, 1987.** Lidstrom, M.E. (Wisconsin Univ., Milwaukee (USA)). Nov 1987. Contract FG02-85ER13386. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003341/JAW.

The purpose of this project has been to use the genetic techniques developed under previous DOE support to study the genetics of C-1 specific functions in methylotrophic bacteria. The approach we have followed has involved analyzing C-1 genes in facultative methanol-utilizers and then using these organisms as hosts to study genes encoding biochemically similar functions from methane-oxidizers. These goals have been accomplished. We have cloned, mapped and characterized methanol assimilation and oxidation genes from a facultative methylotroph and are using these genes and the mutants generated by this work as tools to study genes encoding similar functions in methane-utilizers. In addition, we have cloned a C-1 inducible promoter and are beginning its characterization, we have studied plasmids in methanotrophs, and we have isolated a new methanotroph with attractive growth characteristics. 10 refs., 5 figs., 1 tab.

11159 (DOE/PC/79863—T5, pp 85-90) **Metallic glasses as selective catalysts for synthesis of hydrocarbon liquids in high sulfur conditions.** Brower, W.E. Jr. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The PDSC reactor system has been modified for GC sampling at elevated pressure via a six-port valve with a sample loop. Increased reproducibility over syringe samples will result. Palladium-silicon metallic glass catalysts give trends in Fischer-Tropsch reaction selectivity similar to the iron-boron results. Reflection high-energy electron diffraction is capable of detecting surface-biased phases which are associated with catalyst poisoning. 2 refs., 1 fig., 2 tabs.

11160 **(GULF/C—86) Development of improved synthetic crude processes and their impact on distillate and other product qualities. Final report.** Simmons, R.; Deutscher, R.R. (Gulf Oil Canada Ltd., Sheridan Park, Ontario. Research and Development Dept.). 1986. 126p. (MICROLOG—86-00652). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Four barrels of synthetic crude oil were obtained from Syncrude Canada Ltd. and processed on a pilot plant scale to determine product yields and qualities that could be obtained by using up-to-date refining processes and catalysts. The catalyst screening involved hydrotreating syncrude middle distillate (149/sup 0/C-385/sup 0/C) with 8 commercial catalysts at repeated conditions to ascertain the relative performance of those selected. Two of these catalysts were also used in syncrude gas oil hydrocracking service. The objectives in hydrotreating catalyst performance were to achieve maximum aromatic saturation and minimum distillate cracking. A catalyst was chosen based on these performance criteria and was optimized for a middle distillate production run. The production run product was fractioned into jet and diesel fuels for evaluation. Similarly, one of the two hydrocracking catalysts was chosen based on cracking activity and maximum middle distillate yield from the syncrude gas oil feedstock. The selected catalyst was also optimized and a production run was made to produce jet and diesel fuel for evaluation. 14 figs., 43 tabs.

11161 **(PB—88-132741/XAB) Kelp biomass production: yield, genetics, and planting technology. Annual report, January 1983-August 1984. Technical report.** Neushul, M.; Harger, B.W.W. (Neushul Mariculture, Inc., Goleta, CA (USA)). Jan 1985. 137p. NTIS, PC A07/MF A01.

Progress was made toward the long-term goal of growing macroalgae in the sea as a future source of substitute natural gas. The annual report discusses progress made to: (1) measure macroalgal yield, (2) enhance yield by row planting and selective harvesting, (3) genetically breed high-producing plants, (4) devise methods for planting kelps and (5) maintain and extend collaborative research efforts and communication with scientists working on macroalgal biomass production in Japan, China and elsewhere. The report discusses kelp biology and macroalgal mariculture in general terms, the theories that have been proposed and the existing data base in the scientific literature. Particular attention is given to new techniques used to make in-the-sea hydrodynamic and light-climate measurements and microspectrophotometric measurements of DNA levels in kelp sporophytes and gametophytes.

11162 **(SFERI—87) Investigation of the semiconductor catalysts for the production of liquid fuels. Final report.** Morrison, S.R.; Funt, L.; Colbow, K. (Simon Fraser Energy Research Inst., Burnaby, British Columbia (Canada)). [1987]. 110p. (MICROLOG—87-02219). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objective was to use the unique advantages of semiconductor electrodes to generate radicals, and to apply this to the oligomerization of low molecular weight hydrocarbons, in particular methane, to higher weight (liquid fuel range) hydrocarbons. Stable cation radicals can be formed in triflic acid by hole reactions with low molecular weight alkanes. Specifically propane and ethane were oxidized to stable cation radicals, with possibly some radical formation fro.a methane. Reduction of CO/sub 2/ to methanol was investigated. It was found that a competing reaction involving the corrosion of the semiconductor electrode confused the results. Studies of polymer coatings to protect the electrodes and to carry catalysts were made. Studies of the behaviour of bulk defects in the semiconductor electrodes were made because such defects would destroy the unique selectivity of semiconductor electrodes in radical formation. Conditions for electrode preparation were established.

11163 **(SNC/TD—8603) Technical and economic assessment of producing liquid fuels from natural gas via an electricity-based acetylene process. Phase 2.** Cooke, N.E.; Ashraf, F.A.; Divanji, H.; Konecny, M.; Owerie, P.; Quach, T.-Q. (SNC Group, Montreal, Quebec (Canada). Technical Development Dept.). Mar 1986. 280p. (MICROLOG—87-02209). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This cost-shared study investigated the feasibility of liquid fuel (gasoline) production from natural gas via the novel electic-arc acetylene route. Commercial manufacture of acetylene must involve rapid heating of the feedstock followed by immediate quenching of the product gas to stabilize the acetylene formed and to minimize the decomposition to carbon and hydrogen. The advantage of the electric-arc acetylene route is that hydrocarbon feedstock can be heated very rapidly; therefore, the conversion is high compared to the other thermal processes. The disadvantage is that energy requirement is high, and consequently the proposed method is feasible where electricity is cheap and available. An experimental program was carried out using an existing 100-kW bench-scale arc-reactor facility. The main objective was to optimize the operating conditions by maximizing the acetylene product with minimum carbon formation and low specific energy requirement. Thirty-three exploratory runs were made with two types of feed gas (methane and methane/hydrogen mixture) and three types of quenches (hydrogen, methane, and ethane) under selected range of operating conditions. Description of the electric-arc reactor unit, experimental procedure and the results obtained are presented. A summary of the results and conclusions is given. 11 figs., 11 tabs.

11164 **(SPC—4401-1981-2) Feasibility, operability, and economic studies for energy sources from renewable agricultural waste and other biomass.** Van Der Heijden, S.; Barabas, M.F.; Szladow, A.J. (Saskatchewan Power Corp., Regina (Canada)). Jan 1982. 97p. (MICROLOG—86-01203). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The Saskatchewan Power Corporation initiated a feasibility study on production of electricity from wood in small isolated northern communities in Saskatchewan. The principal conclusions of that program indicated that wood gasification followed by combustion of low-energy produced gas in a modified diesel engine can be an alternative to electricity generation from diesel fuel. The Corporation decided to conduct field trials using a commercially available wood gasifier. A model gasifier-motor-generator was acquired and assembled on a mobile platform first for testing and then field trials in Saskatchewan. The system performed satisfactorily. The gasification efficiency was between 75 and 80 percent. The efficiency for conversion of wood to usable electricity was dependent upon the load and varied from 4 to 14 percent for 20 to 80 percent of the generating capacity. Analysis of electricity cost over a ten year period using wood gasification-motor-generator vs. diesel generator indicated a levelized electricity cost (1981 dollars) equal to 0.204 $/kWh for wood and 0.130 $/kWh for diesel system. High labor charges for wood gasification made it less attractive. Analysis of key economic parameters showed that a significant reduction of electricity cost can be obtained for wood systems if additional automation is introduced at a moderate increase of capital cost.

11165 **(SU/CCREL—850508) Direct production of aromatic hydrocarbons/gasoline from synthesis gas.** Bakhshi, N.N. (Saskatchewan Univ., Saskatoon (Canada). Catalysis and Chemical Reaction Engineering Lab.). 8 May 1985. 115p. (MICROLOG—85-5951). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Synthesis gas conversion reaction was carried out using an isothermal microreactor. Six Fischer-Tropsch (FT) catalysts were prepared and characterised. Five of the catalysts were nickel-zirconia and nickle-cobalt-zirconia preparations with varying Co/Ni ratios. The sixth catalyst was manganese oxide supported nickel-cobalt. The FT catalysts were tested for activity and selectivity for CO hydrogenation. The results obtained in this work are extremely encouraging in as much as high yields of aromatic rich C/sub 5/+ products are obtained with low methane selectivities.

11166 **Optical waveguide sensor for methane gas.** Giuliani, J.F. (to Secretary of the Navy, Washington, DC). US Patent 4,708,941. 24 Nov 1987. Filed date 7 Mar 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for detecting alkanes by forming and detecting clathrate structures of alkanes in a fluid at constant temperatures and pressure is described comprising the steps of: propagating light into an optical capillary waveguide having two ends and a longitudinal surface at end thereof which is closed with an optical stopper and with the other end thereof sealed with a lens-like curvature; obtaining samples of a fluid to be tested; hydrating any alkanes present in the fluid samples to be tested to yield gas mixtures with at least 30% relative humidity; condensing any hydrated alkanes on the surface of the optical waveguide; and detecting alkanes in the fluid to be tested by detecting a parameter of light affected by weak optical surface scattering of light at any condensed alkane-water-optical surface interfaces after propagation through the optical waveguide.

11167 **Steam gasification of biomass with nickel secondary catalysts.** Baker, E.G.; Mudge, L.K.; Brown, M.D. (Pacific Northwest Lab., Richland, WA 99352). *Industrial and Engineering Chemistry Research;* 26: No. 7, 1335-1339(Jul 1987). Contract AC06-76RL01830.

Nickel secondary catalysts are effective for increasing the gas yield from steam gasification of biomass by converting tars and other hydrocarbons to gas. Coke buildup on the catalyst can cause loss of catalyst effectiveness in a very short time. Bench-scale gasification tests showed that coke buildup can be prevented if the catalyst is used in a separate fluid bed reactor. When the catalyst was used in the primary gasification reactor or in a separate fixed bed reactor, rapid catalyst deactivation occurred.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 12488

11168 **(INCO/M—8410) Utilization of methanol fuel as a transportation fuel in mining operations.** (Inco Ltd., Mississauga, Ontario (Canada)). Oct 1984. 277p. (MICROLOG—86-02909). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Methanol substitution in diesel engines used in underground mines has been investigated in relation to conventional fuel savings and emission benefits to be gained. Combustion of methanol/diesel fuel emulsions in the unmodified engine increases the peak cylinder pressures and rate of pressure rise. The addition of a cetane enhancer to the fuel emulsion allows satisfactory engine combustion to be achieved with 15% methanol substitution. An electronic controller was developed to provide a fixed ratio methanol/diesel emulsion to the engine. Steady state engine emissions test results show that total particulate and oxides of nitrogen (NO/sub x/) emissions are reduced by about 20 to 25% with ignition improved methanol/diesel emulsion. The exhaust quality index (EQI) was used to assist in establishing the overall emissions effect of methanol/diesel emulsion. Results show that the EQI is improved by about 17% with emulsion over the transient mines cycle. Economics are presently unfavourable on a fuel substitution basis alone, but may improve if underground ventilation reductions benefits can be achieved.

11169 **(MU/C—8406) The production of methanol by the controlled oxidation of methane at high pressures. Final report.** Morton, L.A.; Hunter, N.R.; Gesser, H.D. (Manitoba Univ., Winnipeg (Canada). Dept. of Chemistry). Jun 1984. 57p. (MICROLOG—87-02229). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report presents a study of the controlled oxidation of methane to methanol by oxygen. The reaction was investigated at several temperatures, at pressures of 50 and 125 atmospheres at three oxygen levels (5, 10 and 20%) for three flow rates at each level. Two reaction systems were devised: monoflow system wherein the reactants (methane, oxygen, small amount nitrogen) were mixed in a single cylinder and dual flow system where the reactants of methane/nitrogen and oxygen were delivered from separate supply cylinders to a small mixing chamber. Reaction analysis was performed by gas chromatography and the data obtained expressed graphically in terms of the percent yield of oxygen in the reaction mixture and flow rate. Yields of methanol of 80% were obtained at 450/sup 0/C and 50 atm at the 5% oxygen level. Material balances for the reactants and products were within 5-10% for carbon. The mono and dual-flow systems are compared.

11170 **(MU/C—8504) Study of direct oxidation of natural gas to methanol. Final report.** Morton, L.A.; Hunter, N.R.; Gesser, H.D. (Manitoba Univ., Winnipeg (Canada). Dept. of Chemistry). Apr 1985. 182p. (MICROLOG—87-02763). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

One hundred percent efficiency of reactant mixing was shown to be essential in the dual flow system and was achieved by incorporating a vernier needle valve to act as a flow constriction and by packing the mixing chamber with Teflon strips. The exit line temperature was restricted to 100/sup 0/C to prevent the decomposition of product methanol. The methanol yield improved with increasing pressure. The optimum methanol yield was achieved at 65 atm at 5% O/sub 2/ concentration. A comparison between the oxidation of methane and the oxidation of natural gas was made. The reduction in operating reaction temperature can be attributed to the presence of ethane and propane in the natural gas which appear to sensitize the reaction. Air was used as the oxidant in place of oxygen for the oxidation of natural gas. Increasing the diameter of the reactor increased the reactant volume flow rate. The methanol yield improved approximately 10% over a glass lined surface. The larger diameter reactor allowed the insertion of both catalyst coated tubes and packed catalysts, and a determination of their effect on the oxidation of natural gas. The highest methanol yields were obtained over an inert wall such as glass or teflon. It was demonstrated that the reaction can be run continously using a recirculation system which allowed the recycling of unconverted natural gas. The recycle system provided for collection of the product methanol and water and the removal of carbon monoxide and carbon dioxide. The residual gas consisting of methane, ethane, and propane was repressurized, remixed with oxygen and reintroduced into the reactor. An economic study is summarized.

11171 **(MU/C—8609) Product optimization of the direct conversion process of natural gas to methanol by controlled oxidation. Final report.** Yarlagadda, P.S.; Morton, L.A.; Hunter, N.R.; Gesser, H.D. (Manitoba Univ., Winnipeg (Canada). Dept. of Chemistry). Sep 1986. vp. (MICROLOG—87-02221). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The direct conversion of methane to methanol is simpler and requires less energy than the presently used synthesis gas method which involves two catalysed reaction steps. The first step involves the catalytic steam reforming of methane, a highly endothermic reaction requiring significant amounts of fuel. Coupled with the formation of methanol from synthesis gas the process is still energy intensive. In the direct conversion of methane to methanol, via controlled partial oxidation, there is a net gain of energy as the reaction is exothermic overall. The effects of sensitization, reactant flow mode, product feed recirculation (after removal of condensible liquid oxygenates) and kinetics of the oxidation reaction were studied in a series of tasks. The introduction of sensitizers into the reaction system considerably affected the reaction conditions while maintaining high methanol selectivities in some cases. Sensitization of the reaction could be an important factor in minimizing reactor heating costs. Higher hydrocarbon compounds may be found in such quantities in certain natural gases in addition to ethane and propane. Sensitization can also occur by using external means such as ultra-violet radiation. Recirculation of the unconsumed methane feed was desirable to improve the conversion and methanol yield. These results demonstrate the insenitivity of the oxidation reaction to high levels of carbon monoxide and dioxide towards methanol selectivity which could considerably reduce the frequency of purging an industrial system and minimize costs.

11172 (NEDOJ—501, pp 891-893) **Development of fuel alcohol technology. Breeding of excellent bacteria .** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report of 1984 on the development of fuel alcohol fermentation technology. In order to develop a host of Zaimomonus strain, vector series, a vector-candidate plasmid was prepared; its safety as a host was confirmed; establishment of spheroplastization and regenerated system was investigated. Ethanol fermentation ability of the Zaimomonus stock under high temperature and high glucose concentration was significantly affected by the composition of a culture medium. Concerning a thermophile, a trial was made in improving the bacillus by NTG treatment and aging in order to increase the concentration of the ethanol formed. A protoplast fusion was experimented in order to give Zaimomonus bacillus stock a resistance against salt. Concerning the cultivation of Zaimomonus bacillus stock, in the glucose/yeast-extract culture medium, pH control at 5 during the cultivation and stepwise addition of glucose were effective for the fermentation.

11173 (NEDOJ—501, pp 894) **Development of fuel alcohol technology. Development of a attached-bacteria method.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on the development of fuel alcohol fermentation technology. (1) A batch-wise fermentation test of demineralized molasses using alcohol fermentation bacillus gave an equal level of fermentation speed as sucrose and black sugar. (2) Such inhibiting substances as salts affecting the fermentation ability was reduced of their influence by diluting the fermentation liquid. (3) A continuous fermentation test of sucrose using Le Bain nonproductive stock showed no improvement in the fermentation yield when compared with the case using Le Bain productive stock. (4) The experimental unit was automated by installing the automatic units for sampling and PH measurement of the fermented solution. (5) Test operation of the test plant revealed the following results: (a) 0.1 kl/d yield of alcohol. (b) Shape of the fermentation vessels, vertical or inclined, showed no special difference. (c) Contamination by miscellaneous bacilli was not observed by the proper selection of the in-vessel conditions.

11174 (NEDOJ—501, pp 896-897) **Development of fuel alcohol technology. Development of flush fermentation method.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on the development of fuel alcohol fermentation technology. (1) Continuous operation (total 6,000 hours) with a compact fermentation unit (1 l/d alcohol production) increased the productivity up to 1.5 times by a flush fermentation for a high density bacillus. (2) Salt resistance of the bacillus stock for flush fermentation was examined for the selection of the stock to be used in the operation of the test plant. (3) Zaimomonus-mobilis stock was utilized to examine the influence of high-density condition of a light-curing resin on the fermentation characteristics. (4) For a high density bacillus to be loaded in a test plant, a condition for the stable storage for more than 3 months was selected. (5) A test plant with 5 kl/d alcohol production was installed at Izumi Alcohol Plant of NEDO. (6) A unit for preparing high density bacillus granules for loading in the test plant was installed at Kinuura Laboratory of NIKKI K.K..

11175 **(ORF/CAFU—3670) Utilization of methanol as a transportation fuel in mining operations. Appendix 3. Final report.** Vergeer, H.C.; Thurston, D.A. (Ontario Research Foundation, Mississauga (Canada). Centre for Alternative Fuel Utilitzation). 28 Sep 1984. vp. (MICROLOG—86-05484). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report summarizes the activities and results of a program to operate a mines diesel engine on unstabilized methanol/diesel emulsion. Combustion pressures and emissions were measured to determine the maximum level of diesel fuel displacement using methanol as an alternative fuel. Combustion pressures and maximum rates of combustion pressure rise are generally increased. Ignition delay is also evident due to the very low ignition quality and high latent heat of vapourizataion of methanol. Engine efficiency is reduced substantially with application of 12% methanol/diesel emulsion. A concentraion of 2.4% octyl nitrate ignition improver in 15% methanol/diesel emulsion was selected to add to the emulsion to improve the combustion and emissions quality of the engine. An electronic controller was developed to provide a fixed ratio methanol/diesel emulsion to the engine. Steady state engine emissions test results show that insoluble particulate and oxides of nitrogen (NO/sub x/) emissions are reduced considerably with ignition improved methanol diesel emulsion. 29 figs.

11176 **(EMR—M91-7/7-1987E) Application of a newly developed fermenter-purifier system for the production of fuel/alcohol. Final report.** Christison, J. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 19 Nov 1986. 122p. (MICROLOG—87-04554). Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The application of a novel fermenter-purifier system to the fermentation of glucose to acetone/butanol/ethanol (ABE) by Clostridium acetobutylicum, ATCC 824 has been investigated. The data confirm that the concept of simultaneous fermentation, removal, and recovery of volatile solvents by vapour phase stripping is feasible. However, due to the more complex metabolic control mechanisms of the ABE fermentation compared with those of ethanol formation by Saccharomyces cerevisiae, additional studies are required to optimize the yield and stabilize the ABE fermentation under the conditions of continuous vapour phase stripping. Preliminary data indicate that the fermenter-purifier concept employed with the use of selective adsorbents could significantly improve the economics of the production of butanol/acetone from glucose. 19 figs., 19 tabs.

0903 Inorganic Hydrogen Compound Fuels

11177 **(CONF-8709201—1) The chemistry of the hypochlorite neutralization of hydrazine fuels.** Brubaker, K.L. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002971/JAW.

From 3. conference on the environmental chemistry of hydrazine fuels; Panama City, FL, USA (15 Sep 1987).

Neutralization of hydrazine fuels with hypochlorite is a recommended procedure for the treatment of fuel spills prior to disposal. Various research workers have shown, however, that incomplete reaction of hypochlorite with the methylated hydrazine fuels monomethylhydrazine and unsymmetrical dimethylhydrazine leads to a wide variety of byproducts, including N-nitrosoalkylamines. The known reaction products and mechanisms are reviewed and summarized. 23 refs.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 11204, 11236, 11656, 12425

11178 **(CR—8602) A wood-waste fuelled, indirectly-fired gas turbine cogeneration plant for sawmill application. Phase 1. Preliminary engineering design and financial evaluation.** (Evans (R.L.) and Associates (Canada); Bachrich Consulting Ltd. (Canada)). Feb 1986. 58p. Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C.

Most sawmills generate more than enough wood waste to be potentially self-sufficient in both dry-kiln heat and electricity requirements. It is not generally economically viable to use conventional steam/electricty cogeneration systems at the sawmill scale of operation. As a result, Canadian sawmills are still large consumers of purchased fuels and electricity. The overall objective of this project was to develop a cost-effective wood waste-fired power generation and lumber drying system for sawmill applications. The system proposed and evaluated in this project is a wood waste-fuelled, indirectly-fired gas turbine cogeneration plant. Research, design, and development of the system has been planned to take place in a number of phases. Phase 1 consists of a preliminary engineering design and financial evaluation of the system, the subjects of this report. The results indicate that the proposed indirectly-fired gas turbine cogeneration system is both technically and financially feasible under a variety of conditions. 8 figs., 8 tabs.

11179 **(DOE/OR/21389—T4) Economic impacts of wood energy in the Northeast, 1985: Summary report: Northeast Regional Biomass Program.** Chamberlin, R.; High, C. (Dartmouth Coll., Hanover, NH (USA). Resource Policy Center). Apr 1986. Contract FG05-83OR21389. 22p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003556/JAW.

Wood energy in the Northeast accounts for an estimated average of 1.96 jobs and $46,634 of income for every 1000 tons of wood burned by households and businesses. This translates into an estimated total of over 78,000 jobs and $1.8 billion of personal income for Northeast residents and businesses. In addition, a total of $589 million in state and federal tax revenues are generated by wood energy-related economic activity. By choosing wood over other fuels, Northeast households and businesses saved $1.2 billion in their 1985 fuel bills. In the Northeast in 1985, wood displaced over 1 billion gallons of oil, 37 million tcf of natural gas and propane, 138,000 tons of coal, and 1858 million kilowatt-hours of electricity. Projected growth in wood energy consumption in the industrial and residential sectors indicate that the Northeast wood energy industry will support approximately 165,000 jobs and $3.8 billion of personal and business income by the year 2000, if projected growth continues. 9 figs., 5 tabs.

11180 **(DOE/OR/21389—T6) PURPA [Public Utility Regulatory Practices Act] implementation: Policy issues and choices: The Northeast Regional Biomass Program.** Salgo, H. (Salgo and Lee, Boston, MA (USA)). 9 Apr 1986. Contract FG05-83OR21389. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003553/JAW.

The purpose of this report is to provide some guidance in the structuring of state rules for the implementation of Public Utility Regulatory Practices Act (PURPA) of 1978. The problem posed here is how might rules be structured to allow for the development of biomass facilities which qualify, but which are not biased in favor of non-renewable resources? Such protects are likely to have different requirements necessary for their development than, for example, hydroelectric facilities. In a general comparison of the two, biomass projects will be fuel and fuel contract dependent, less capital intensive, and more likely to be dispatchable on an annual basis. In addition, biomass facilities may be cogenerators and have available to them more than one revenue stream. Biomass facilities may also be more likely than the hydros to go out of business during the term of the contract.

11181 (DOE/OR/21389—T9) Feasibility and case studies of wood fuel feedstocks in resource recovery facilities: Northeast Regional Biomass Program. White, A.L. (Boston Planning Group, Inc., MA (USA)). Dec 1986. Contract FG05-83OR21389. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003559/JAW.

Wood and municipal solid wastes (MSW) are essentially compatible solid fuels. Solid waste streams already contain a sizeable fraction of wood and at least two industrial facilities in the Northeast rely exclusively on urban wood wastes which otherwise would be hauled to landfills. For the dozens of resource recovery facilities (RRFs) in the planning, construction, and operational stage throughout the Northeastern states, the utilization of fuel wood chips, mill residues or concentrated amounts of urban wood wastes presents no major technological barriers. As long as the wood fraction is kept below the 30% range, it is unlikely that the combustion process will be altered to the point where major boiler redesign would become necessary. Either co-firing or co-utilization address circumstances which historically have impeded the implementation of RRFs - the assembly of threshold volumes of feedstocks; procurement of an interim fuel until sufficient jurisdictions are under contract; supplementary fuel to level seasonal fluctuations in the waste stream; and protection against unanticipated disruption of the flow of waste to the RRF. In addition, the possibility of improved emissions' control through fuel blending offers still another incentive for developers and communities to consider MSW-wood combinations. Based on recent experience of RRFs in the CONEG region and on the Pennsylvania, New York, and New Jersey scenarios presented in this report, the first two rationales - threshold volumes and contractual delays - are the most probably short-term incentives to co-utilize fuels. In any event, buy-back rates in the cents4/KWH range are sufficient to justify fuel mixing under existing market conditions. The effect of wood costs on facility profitability under conventional engineering assumptions is, in general, quite marginal and is unlikely to effect substantially the decision to mix fuels. 14 refs.

11182 (PB—88-109392/XAB) Development of a dual-fuel charcoal-biomass gasifier. Special report. Marais, J.K. (National Timber Research Inst., Pretoria (South Africa)). May 1986. 112p. (CSIR/SR/HOUT—426). NTIS, PC E07/MF E07.

North American Continent sales only.

A comprehensive study of the gas produced from biomass and the present technique and equipment used revealed a number of serious shortcomings that were investigated and defined. A new concept of gasification, embracing fundamental changes in both the mechanical design and the fuel, is used. This concept culminated in a design proved by test to eliminate these shortcomings. A tar-free dry gas was produced in a dual-fuel gasifier. In the design, wood charcoal is used as a fire bed and a relatively fine biomass, such as sawdust, is fed into the fire bed in quantities to match the load demand at any moment. Attempts were made to pyrolize the sawdust by means of the waste heat carried off in the generated gas.

11183 (WSL-LR—512(MR)) Refuse derived fuel firing trials on an underfeed stoker shell boiler at Eastbourne Sixth Form College. Scott, D.W.; Woodfield, M.J.; Webb, M. (Warren Spring Lab., Stevenage (UK); UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). 1987. 36p. (ETSU-B—1136(b)). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks LS23 7BQ.

Firing trials have been undertaken on an underfeed stoker/shell boiler system fuelled with refuse derived fuel pellets. Whilst it was possible to operate the boiler at its nominal rating of 0.56 MW, it proved difficult to decrease the excess air rate to a level where both sensible heat losses and flue gas emissions were acceptable. Under optimised conditions of maximum useable heat recovery, typically 73% thermal efficiency compared to the original value of 60%, heat input was 0.49 MW with associated stack losses of 25% and carbon-in-ash of less than 1.5%. The boiler operated with a satisfactory smoke emission provided that it was regularly de-ashed about which recommendations have been made. Similarly, recommendations have been made regarding the required chimney height to reduce ground level concentrations of SO/sub 2/ and HC1 to acceptable levels. Emissions of lead and cadmium were not thought to present a problem. The boiler deposits were found to be enriched with the heavy metals, lead and cadmium, and appropriate safety measures should be taken when cleaning out the boiler transfer tubes. Ash handling and clinkering were found to be problem areas requiring further work.

11184 (WSL-LR—590-MR) Refuse derived fuel combustion trials: the atmospheric fluidised bed at Northern crop dryers. Scott, D.W.; Burnley, S.J. (Warren Spring Lab., Stevenage (UK); UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). 1987. 32p. (ETSU-B—1136-a). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks LS23 7BQ.

Northern Crop Dryers produce silage pellets from grass in a system utilising two Worsley atmospheric fluidised bed furnaces as the source of heat generation. The furnaces were designed for coal combustion but recently Refuse Derived Fuel (RDF) pellets have been burned. A combustion trial was carried out at the Northern Crop Dryers plant to compare the performance and handling characteristics of RDF with those of coal. RDF compared favourably with coal, giving a useful heat recovery of 90%. Latent heat losses at 10% were twice those found for coal. RDF combustion was very efficient and this was reflected in the low heat loss attributable to carbon in ash which was only half that for coal. 1.8 tonnes of RDF were required to produce the equivalent amount of heat to one tonne of coal. Contamination of the dryer product with entrained particles in the flue gas was greater with RDF fuelling, particularly with regard to lead, where the statutory limits were exceeded. Gas cleaning or indirect heating would eliminate this problem, but would cause other technical difficulties and be uneconomic. It is concluded that this system is not suitable for processing feedstuffs when fired with RDF.

11185 (WSL-LR—595-MR) ETSU/WSL refuse derived fuel combustion trials programme: a review of progress. Burnley, S.J. (Warren Spring Lab., Stevenage (UK); UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). 1987. 33p. (ETSU-B—1136-f). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Warren Spring Laboratory (WSL) is engaged in a programme of refuse derived fuel (RDF) combustion trials on a range of coal fired stokers for the Department of Energy's Energy Technology Support Unit (ETSU). The purpose of this study is to determine which systems are suitable for RDF firing and to investigate the technical, environmental and economic implications of conversion to RDF firing. The programme consists of three phases preliminary tests, comprehensively monitored tests and long term assessments. The second phase trials are now nearing completion and the results obtained to date are summarised. The following systems are thought suitable for long term monitoring in the final phase of the project: single chain grate stokers, fixed bed stokers, underfeed stokers and watertube chain grate boilers.

11186 (WSL-LR—611-MR-M) Combustion of refuse derived fuel on a fixed grate stoker shell boiler at W and T Avery Ltd. . Burnley, S.J. (Warren Spring Lab., Stevenage (UK); UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). 1987. 23p. (ETSU-B—1136-g). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Refuse Derived Fuel (RDF) combustion trials were undertaken on a Babcock Robey shell boiler fitted with a Greenforge fixed grate stoker and rated at 1.47 MW. A maximum output of 1.51 MW at a thermal efficiency of 80% was achieved compared to 1.56 MW and 88% during a coal fired baseline test. The particulate emissions from RDF burning were within limits stipulated by the Clean Air Act for a combustor of this size, and the fuel and ash handling systems were suitable for RDF use. The unit was found to operate well during the trials and it is recommended that RDF firing is adopted on a long term basis. Monitoring to be carried out over this period will provide information on both the economics of converting to RDF and the technical aspects of burning RDF on this type of unit for extended periods.

13 HYDRO ENERGY

11187 (PB—88-107925/XAB) Field measurements of dissolved air at Ulset hydroelectric plant in Norway. Technical report (Final). Berg, A.; Kjoerholt, H. (Norsk Hydroteknisk Lab., Trondheim). 20 Mar 1987. 136p. NTIS, PC E07/MF E07.

Also pub. as Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway) rept. no. STF60-A87031.

The interaction between water, air, and rock in an underground water-balanced Compressed Air Energy Storage (CAES) power plant may have consequences for the stability of the plant. To measure this interaction, an unlined air cushion surge chamber at a Norwegian power plant was used. Such a surge chamber is anticipated to closely resemble the behavior of CAES plants mined in hard rock. The measurements taken inside the chamber consisted of the following: analysis of the water under the air cushion for dissolved gases, chemical composition and density differences due to differences in gas (air) saturation; analysis of the chemical composition of the surge chamber air and recording of temperature both in air and water phase. In addition, water level in the surge chamber and reservoir, plant operation, and air leakage from the chamber were recorded. The report describes the surge chamber, the instrumentation, the measuring methods used, and the results.

1304 Regulations And Licensing

REFER ALSO TO CITATION(S) 11646

1306 Environmental Aspects

11188 (DOE/BP/10062—3) Impacts of water levels on breeding Canada geese and methods for mitigation and management in the southern Flathead Valley, Montana: Final report. Mackey, D.L.; Gregory, S.K.; Matthews, W.C. Jr.; Claar, J.J.; Ball, I.J. (Confederated Salish and Kootenai Tribes, Pablo, MT (USA); Bureau of Indian Affairs, Ronan, MT (USA). Flathead Agency; Montana Cooperative Wildlife Research Unit, Missoula (USA)). Nov 1987. Contract AI79-83BP10062. 171p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88003962/JAW.

Kerr Hydroelectric Dam is located at the south end of Flathead Lake, controls water levels on the lake and the Flathead River below the dam, and is currently operated as a load control facility. Current operation of Kerr Dam creates the greatest yearly water level fluctuations on both the lake and river during the Canada goose (Branta canadensis moffitti) brood and nesting period. Data collected from 1980-1982 indicated that goose nest numbers on the river were lower than during the 1950's, and that brood habitat on the lake may be limiting the goose population there. Our study was conducted from 1983-1987 to determine the effects of Kerr Dam operation on Canada goose populations and habitat on the south half of Flathead Lake and the Flathead River, and to formulate management and mitigation recommendations. Nesting geese on the river appeared to be negatively affected by a lack of nest sites free from predators, and responded to available artificial nest structures with an increase in nest numbers and nesting success. Under current dam operation, river channel depths and widths do not discourage access to nesting islands by mammalian predators during some years and high predation on ground nests occurs. Intensively used brood areas on the lake and river were identified and described. Brood habitat on the lake was lower in quality and quantity than on the river due to dam operations. Gosling mortality on the lake was high, almost 2 times higher than on the river. Lake broods expended more energy obtaining food than river broods. Losses of brood habitat in the form of wet meadow marshes were documented and mitigation options developed. Management/mitigation alternatives and monitoring methods for nesting and brooding geese were identified.

14 SOLAR ENERGY

11189 (JSES—602, pp 109-112) Basic study on solar heat storage based on concentration difference. Fujii, Ishine; Higuchi, Akon; Ohashi, Yoshiaki. (Meiji Univ., School of Engineering, Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

An experimental study is performed for water solution of calcium chloride, a suitable solution for the captioned subject, and the condensation of the solution using hydrophobic film comparing to the semipermeable membrane. The relationship between saturated steam pressure and temperature, in regard to a water solution of 30-50 wt percent is clarified after testing the effect of solution concentration to the increase of boiling point. Next, the state of precipitated solute is examined as a possible problem to encounter during film condensation. The experiment reveals that solidification heat is instantaneously evolved when the solute is precipitated. Performance characteristics of the hydrophobic film are tested with a cylindrical water solution tank in which a PTFE porous film of 0.6 Mum hole diameter is sandwitched at one end. Test result reveals relationships between solution temperature, surface temperature in the steam side of the cooling plate and the quantity of condensed liquid in transmitted steam. (5 refs, 6 figs, 2 tabs)

11190 (JSES—602) Proceedings of the 12th Symposium of Japan Solar Energy Society. (Japan Solar Energy Society, Tokyo). Dec 1986. 194p. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

The proceedings from the 12th symposium of the Japan Solar Energy Society are presented.

11191 (JSF—701, pp 76-88) Practical use of natural energy in mountainous district. Torii, Makoto. (Ikutoku Technical Univ., Kanagawa, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

Natural energy such as wind, solar and hydro-electric energies is increasingly harnessed in mountainous districts. Especially, the case of Hodaka Mountain Hut is presented to illustrate the wind and photovoltaic powergeneration. The sectional shape of propeller was selected mainly aiming at the design of a propeller rotating even by the gentle wind in summer. It is necessary to take measures to prevent the propeller from breaking by a just peculiar to the mountainous district. The measures are kept within the limits so that the generator is prevented from being damaged by breaking of the propeller in advance. The photovoltaic power generator is installed as the backup generator in windless summer. Since the solar radiation is sharply decreased in the afternoon up in the mountain, it must be considered that solar cells generate more electricity in the morning than in the afternoon. (16 refs, 8 figs, 4 tabs)

1401 Resources And Availability

REFER ALSO TO CITATION(S) 11233

11192 (JSES—602, pp 5-8) Threshold of direct solar radiation quantity, a basic data for solar thermal power generation. Terada, Koichiro. (Electrotechnical Lab., Ibaraki, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The captioned data is studied by referring to one year sunshine time test data gathered by rotary pyranometer developed and tested by the Meteorological agency (threshold is 0.12 kw/m^2 by the intensity of direct solar radiation, sampled once every 30 seconds and displayed by 1 pulse after 4 times, namely 2 minutes) and related quantity of direct solar radiation. Thus, a threshold of 07-08 is selected for the duration of bright sunshine applicable to solar power generation. This value and the data of direct solar radiation

quantity can be used for planning, designing and operating a system of more precise power generation quantity. (7 refs, 2 figs, 3 tabs)

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 10754, 10755, 10756, 10757, 10758, 10759, 11156, 11161, 11167, 11182, 11270, 11317, 11656, 11660, 12006, 12612, 12636, 12763

11193 (AD-A—185238/3/XAB) Metallization systems for stable ohmic contacts to GaAs. Tandon, J.L.; Douglas, K.D.; Vendura, G.; Kolawa, E.; So, F.C. (California Inst. of Tech., Pasadena (USA)). 1985. 11p. NTIS, PC A03/MF A01.

A metallization scheme to form reproducible and stable ohmic contacts to GaAs is described. The approach is based on the configuration: GaAs/X/Y/Z; where X is a thin metal film (e.g. Pt, Ti, Pd, Ru), Y is an electrically conducting diffusion barrier layer (TiN, W, or W(0.7)N(0.3), and Z is a thick metal layer (e.g. Ag) typically required for bonding or soldering purposes. The value and reproducibility of the contact resistance in these metallization systems results from the uniform steady-state solid-phase reaction of the metal X with GaAs. The stability of the contacts is achieved by the diffusion barrier layer Y, which not only confines the reaction of X with GaAs, but also prevents the top metal layer Z from interfering with this reaction. Applications of such contacts in fabricating stable solar cells are also discussed.

11194 (BMFT-FB-T—86-204) Development of a manufacturing unit for selective coating of solar absorbers made out of aluminium. Final report. Stemmer, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750985/JAW.

Selective coatings are of a great importance for solar technology; their advantages can be completely used only when being produced economically. For solving this problem an experiment was started: trying to integrate a manufacturing unit for selective coating into an existing anodizing plant. The SOLAROX-film, developed by Dornier-System GmbH, offered ideal pre-conditions. Basing on a detailed description of the coating process the manufacturing unit was planned in a way as to make possible the economic coating of current solar absorbers by using the periphery of the anodizing plant - without disturbing the running of the plant. After having installed the unit all components were tested concerning technical function, reliability and security. The coated samples also were examined closely concerning their optical and technical characteristics. Having finished the trial working, manufacturing instructions were supplied and the staff was trained. During the trial phase 2 problems occurred who ought to be solved in a succeeding project: the contamination of sodium and the negative influence of seal poisons. With 3 refs., 3 tabs., 11 figs.

11195 (DOE/BP/17609—4) Harvesting overstocked stands of small diameter trees: Report No. 4: Cost and productivity of new felling and forwarding equipment. Lambert, M.B.; Howard, J.O. (Forest Service, Portland, OR (USA). Pacific Northwest Research Station). 1 Jul 1987. Contract AI79-84BP17609. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003744/JAW.

This report describes the felling, bunching, and forwarding operations now working in the doghair stands on the Quilcene District. The felling was done with a Washington Logging Company FB-1 steep slope feller/buncher. The forwarding was done with a Timberjack 520A rubber-tired forwarder. Productivity and cost studies were required by the service contract between the Forest Service and the logging company. The intent of the studies was to capture the comprehensive technical and economic information provided by early operation of the total small tree harvesting and utilization system. This report focuses on the felling and delivery of the trees to the central processing system. 7 refs., 9 figs., 7 tabs.

11196 (DOE/CH/10198—T2) Artificial photosynthesis using chlorophyll based carotenoid quinone triads: A brief synopsis of research progress as of 31 December 1986. Gust, D.; Moore, T.A. (Arizona State Univ., Tempe (USA). Dept. of Chemistry). 31 Dec 1986. Contract FG02-84CH10198. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003340/JAW.

The design, synthesis and study of a series of carotenoid-chlorophyll-quinone triad molecules which mimic some of the basic photochemistry and photophysics of natural photosynthesis is sought. The first members of this series have now been prepared, and have been found to mimic photosynthetic charge separation, carotenoid antenna function, and carotenoid photoprotection from singlet oxygen damage. Although the triad molecules mimic the general principle of multistep electron transfer which is found in natural photosynthesis, the details of photosynthetic electron transfer differ in the triads, in that the first electron transfer step involves electron donation from the excited state donor, followed by reduction of the resulting donor radical cation by the carotenoid. In photosynthesis, the electron is moved through several acceptors before the chlorophyll radical cation is reduced. Therefore, our recent work has concentrated on the design and synthesis of new model systems which better mimic certain aspects of natural photosynthesis.

11197 (DOE/CH/10198—T3) Artificial photosynthesis using chlorophyll based carotenoid quinone triads: Technical progress report, [16 June 1985 to 28 February 1986]. Gust, D.; Moore, T.A. (Arizona State Univ., Tempe (USA). Dept. of Chemistry). 28 Feb 1986. Contract FG02-84CH10198. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003338/JAW.

The purpose of this project is to design, synthesize, and study tripartite chlorophyll-carotenoid-quinone molecules which mimic the early, energy conserving steps of natural photosynthesis. The synthetic molecules should mimic the photodriven multistep electron transfer reactions of photosynthesis which generate high-energy, long-lived charge separated states. They should also mimic carotenoid antenna function, which involves transfer of singlet energy from the carotenoid to the chlorophyll derivative, and photoprotection from singlet oxygen damage, which involves transfer of triplet energy from the chlorophyll derivative to the carotenoid. This report describes the synthesis and study of chlorophyll-based carotenopyropheophorbide-quinone triad molecules which mimic all of the natural processes mentioned above. Irradiation of one of these molecules in methylene chloride solution initiates a two-step electron transfer leading to the formation of an energetic charge-separated state with a lifetime of 120 ns and a quantum yield of ~4%. 12 refs., 17 figs.

11198 (DOE/CH/10199—T2) O_2 evolution from water by the water-dehydrogenase enzyme: Annual report, June 15, 1984-June 14, 1985. Dismukes, C. (Princeton Univ., NJ (USA)). 1985. Contract FG02-84CH10199. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88004522/JAW.

The objective is to isolate and characterize the functional enzyme responsible for O_2 evolution from spinach membranes. Since the O_2-evolving complex is a membrane bound enzyme this involves finding conditions which allow for the dissociation of the functional enzyme from the membrane without loss of essential subunits or cofactors. A 33kDa, peripheral-membrane protein from thylakoid membranes is released on osmotic shock or on alkaline-salt washing and is correlated with the release of 2 Mn ions. Concomitant with release of this 33 kDa protein and manganese is the release of a 10 kDa polypeptide. Salt-washing at progressively higher pH progressively releases both polypeptides and manganese with increasing yield. This release correlates inversely with the residual O_2 evolution activity in the depleted membranes and with the yield of the S_2 multiline EPR signal due to the functional binuclear manganese site of the water dehydrogenase enzyme.

11199 **(DOE/CH/10203—T1) Rapid liquid phase epitaxial growth studies of GaAs: Progress report, July 1984-March 1985.** Daly, J.T.; Gerritsen, H.J.; Karlsson, S.K.F.; Crisman, E.E. (Brown Univ., Providence, RI (USA). Dept. of Physics). Mar 1985. Contract FG02-84CH10203. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003343/JAW.

An approximate model of gallium arsenide crystal growth from a solution in laminar flow has been developed and efforts continue on an exact model using computer simulation and finite-element analysis. Calculations indicate that growth rates 50 to 100 times larger than those encountered in conventional LPE can be expected. This leads to the possibility of application of this method in the volume production of photovoltaic devices.

11200 **(DOE/CH/10203—T2) Rapid liquid phase epitaxial growth studies of GaAs: Progress report, July 1985-February 1986.** Crisman, E.E.; Daly, J.T.; Gerritsen, H.J. (Brown Univ., Providence, RI (USA). Dept. of Physics). Feb 1986. Contract FG02-84CH10203. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003346/JAW.

The design and construction of a system for growing LPE gallium arsenide from a rapid flow liquid melt has been completed. Evaluation of the performance of the system components has been positive and a first growth was completed proving the qualitative worth of the system. Quantitative growth analysis is being delayed until the arrival and installation of the differential pressure gauge required for accurate control and monitoring of the liquid metal solution flow. The interim time is to be spent on set-up and refurbishing of the equipment necessary to analyze the LPE layers as they become available. Graduate student personnel are being trained in the operation, maintenance and preparation procedures of both LPE layer growth and analysis. The development of the mathematical model has been expanded to include the transient conditions at the beginning of the growth cycle and a publication has been prepared for submission which describes the details of the calculational technique and predicted results.

11201 **(DOE/CH/10203—T4) Rapid liquid phase epitaxial growth studies of GaAs: Final report, July 1984-June 1987.** Gerritsen, H.J.; Crisman, E.E. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1987. Contract FG02-84CH10203. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003345/JAW.

Single crystal layers of gallium arsenide have been grown on (111) and (100) oriented GaAs substrates from a flowing, GaAs saturated, gallium solution with a few degrees temperature differential across the liquid/solid interface. Very high growth rates, on the order of 8μm per minute, have been observed. Such rates are in agreement with the growth theory developed as part of this program, and are about two orders greater than those typically achieved in conventional, static solution, liquid phase epitaxy. Both undoped and p-doped (Si) GaAs layers have been grown and some of their material properties measured. Good crystallinity was inferred from the narrowness of x-ray diffraction lines and from the intensities of the photoluminescence responses of all specimens sampled. While these results do not prove that the epi material is of photovoltaic quality, they indicate both a high crystallographic perfection and a low density of life-time poisoning impurities; conditions which are usually necessary for PV device development. Thus far, smooth surfaces have not been produced directly by the rapid liquid phase epitaxy (RLPE) process. The rough surface morphologies are due, at least in part, to incomplete wipe off of the liquid when the substrate is withdrawn at the end of the growth cycle. Another potential source is growth instabilities which will be discussed later. This report summarizes the three year research program of the RLPE process sponsored by DOE-SOLERAS.

11202 **(DOE/ER/13506—3) Photochemical solar energy conversion utilizing semiconductors localized in membrane mimetic systems.** Fendler, J.H. (Syracuse Univ., NY (USA). Dept. of Chemistry). 1987. Contract FG02-86ER13506. 6p. (CONF-870666—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002887/JAW.

From 11. DOE solar photochemistry research conference; Tahoe City, CA, USA (7 Jun 1987).

Synthetic surfactant vesicles, polymerized vesicles, and bilayer lipid membranes (BLMs) are the membrane mimetic systems which compartmentalize the catalyst-coated microcrystalline semiconductors and sacrificial electron donors. BLM-incorporated semiconductors allow the simultaneous spectroscopic and electrical monitoring of photoelectron transfers on and across ultrathin membranes. Quantum size effects have been established in the generation of CdS particles in dioctadecyldimethylammonium chloride (DODAC) surfactant vesicles. Depending on the method of preparation and the stoichiometrical amounts of H_2S added, CdS semiconductor absorption edges were found to range from 478 to 385 nm, corresponding to particle diameter variations between >50 and 22 A. Surfactant vesicles provide differential sites for CdS formation, shift the equilibrium between nucleation and particle growth toward the former, stabilize the growing particles along with the anions present (Cl^-, OH^-, $EDTA^{3-}$, and SH^-), and, most importantly, allow a convenient control of particle sizes and size distributions. The smallest sized CdS particles with the narrowest size distribution were obtained in preparation A. Importantly, smaller sized DODAC-vesicle-entrapped CdS particles were shown to undergo more efficient, photosensitized electron transfer to methylviologen than larger ones. 17 refs., 1 fig.

11203 **(DOE/ER/13621—1) Transcriptional analysis of the R locus: Progress report, September 1986 through October 1987.** Wessler, S.R. (Georgia Univ., Athens (USA). Dept. of Botany). Nov 1987. Contract FG09-86ER13621. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003642/JAW.

The R locus controls where, when and how much anthocyanins are expressed in at least 11 different tissues of the corn plant and seed. Enormous natural variation has been seen when the phenotypes of different R alleles are compared in a common genetic background. Some alleles have been shown to have a compound structure resulting from gene duplication and divergence. In these complex alleles, each member of the duplication (called R genic elements) has a unique pattern of expression. The function of the R locus is not known; genetic and biochemical analyses suggest that it may encode a protein that regulates other genes in the anthocyanin pathway. Over the past year we have determined that the genic elements (P), (S), and (Lc) all encode a very rare 2.8 kb transcript that is present in tissue displaying anthocyanin pigmentation. cDNA libraries have been constructed using mRNA isolated from tissues shown by Northern blots to be enriched for the R transcript. Full-length cDNAs will be sequenced and compared to each other.

11204 **(DOE/OR/21389—9) Impact of large biomass demand centers on the forest resource base.** (Associates in Rural Development, Inc., Burlington, VT (USA)). 13 Aug 1986. Contract FG05-83OR21389. 170p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88003520/JAW.

This study explored the impacts of four wood-fired power plants on wood procurement systems and forest management in portions of the northeastern United States. The objective was to clarify the nature and extent of a wide range of possible impacts on forests and wood supplies from the operation of wood-fired power plants. This study was designed to gain a broad understanding of the harvesting-supply system, recognizing the methodological problems that would be encountered in a broad-scope study with limited financial resources. While the study was not expected to define specific impacts conclusively, it was expected that significant trends could be identified which will provide important information to policymakers and new directions for research. Those objectives were achieved by development of descriptive case studies of four wood-fired power plants located in Maine, Vermont, New York and Maryland; by surveys of loggers, foresters, chip suppliers and landowners who are directly involved in fuelwood chipping operations; and by on-site, post-harvest examinations of forest stands in northern New England that have been harvested to provide chips for wood-fired power plants. 234 refs.

11205 **(ES—860929) Use of organosolv processes.** (Econotech Services Ltd., New Westminster, British Columbia (Canada)). 29 Sep 1986. 173p. (MICROLOG—87-04599). Renewable Energy Branch, Energy Mines and Resources Canada, 460 O'Connor Street, Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This work provides an independent technical assessment of the potential of organosolv pulping to supply pulp, hemicellulose and lignin as usable raw materials. Aspen wood chips were pulped with methanol-water and ethanol-water mixtures at 190°C in a pilot scale digester. The lignin was precipitated from the spent liquor by addition to acidified water and the separated liquor condensed in a flash evaporator. Material balance calculations were made from analytical data obtained throughout the processing. An inherent conflict between the requirements of high pulp strength and high recovery of hemicellulose was revealed. Highest strength was achieved at 66% pulp yield, but at that yield 50% of the hemicellulose and 30% of the lignin remained in the pulp. The liquors were found to be very toxic to fermentation bacteria thus needing a purification treatment to allow fermentation of the hemicellulose sugars.

11206 **(FCC—04/53/68/705) Utilization of hemicellulose from wood after organosolv treatments.** Chan, M.K.-H.; Wilson, J.J.; Yu, E.K.C. (Forintek Canada Corp., Ottawa, Ontario). Nov 1986. 72p. (MICROLOG—87-04631). Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The organosolv pulping process produces a spent liquor containing a high level of hemicellulose carbohydrates, primarily pentosan. The conversion of this potential waste stream into a marketable byproduct such as ethanol or butanediol by fermentation using the pentose-fermenting bacterium Klebsiella pneumoniae would improve the economics of organosolv over the conventional pulping processes. A series of organosolv spent liquors were characterized with respect to carbohydrate content (pentose, pentosan), lignin content, and their potential fermentability to produce 2,3-butanediol and ethanol. The majority of the samples contained pentosans comprising 25 to 40% (w/v) of the total solids. Total lignin contents were less than 10% (w/v) of the total solids. Fermentation results indicated the presence of compounds which inhibited the growth and fermentation of K. pneumoniae as all butanediol yields were less than 20% of the control yields. Several attempts to remove the toxic compounds by standard procedures were unsuccessful. A combination of ion-exchange and gel filtration was used to separate a totally fementable fraction of the spent liquor; however, the remaining pentose in this fraction represented less than 10% of the original pentose present in the spent liquor. The unidentified toxic compounds were shown by high perfomance liquid chromatographic analysis to be closely associated with sugar-degradation materials and not the lignin components present in the spent liquors.

11207 (JSES—601, pp 17) **Present status and forecast of research for added value of terrestrial biomass .** Nishimura, Hiroyuki. (Hokkaido Univ., Faculty of Agriculture, Sapporo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A02. Order Number DE88770031/JAW.

In Advanced utilization of solar energy. Utilization for biotechnology.

Research for the production of resource energy through the cultivation of plants which will have good photosynthetic capability and grow naturally even on dry land is important. Basic requirements for terrestrial biomass are quick growth with efficient solar energy utilization, possession of energywise valuable components, inclusion of much economically useful components, and being nontoxic. From the viewpoint of efficient utilization of resources, eucalyptus was studied for addition of values using microbes (aspergillus niger). Eucalyptus essential oil was found, through the study, to possess a high evading effect towards mosquitos. Further, one having a long lasting effect with no offensive smell was found. Because eucalyptus requires a long time before it can be transplanted, clonal proliferation method was employed to shorten the seedling period. It was learned that lemon eucalyptus could be increased 3 times by a series of culture(45 days). (18 refs, 7 figs, 3 tabs)

11208 (JSES—601, pp 15-21) **Production of fats and oils, and fuel oil from microbial algae.** Iwamoto, Hiroaki. (Meiji Univ., School of Agriculture, Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A02. Order Number DE88770031/JAW.

In Advanced utilization of solar energy. Utilization for biotechnology.

To select microbial algaes for the production of fats and oils, those which will contain much fats and oils in propagating algaes should be looked for. A specific diatom called Phaeoductylum will well meet the requirements, containing 25 -30% fats and oils in its normal situation. In general, it is very difficult to extract fats and oils contained inside cells. This is not desirable from the fats and oils production point of view. As an exceptional case, there is a green algae named Botryococcus braunii. It stores hydrocarbon in the intercellular spaces in quantity of as much as 50% of the biomass. It is now recognized that oil shales observed in may places originated from microbial algaes. Production of petroleum hydrocarbon by cultivating the algaes in quantity is not an easy attemp, but revealed to be feasible. Several litters of hydrocarbon from Botryococcus of artificial culture is about to be obtained.

11209 (JSES—601, pp 22-34) **Production of glycerol by the halotolerant algae Dunaliella. Model system for biosolar energy conversion.** Ben-Amotz, A. (Israel Oceanographic and Limnological Research National Inst. of Oceanography, Haifa, Israel). Dec 1986. NTIS (US Sales Only), PC A02. Order Number DE88770031/JAW.

In Advanced utilization of solar energy. Utilization for biotechnology.

Most living cells cannot tolerate environments in which the sodium chloride concentration exceeeds 15%. However, a genus, Dunaliella, stands out as the only eukaryotic and photosynthetic organism able to grow in media containing a very wide range of salinities, from 0.5% to saturation. The osmoregulatoty mechanism in Dunaliella varies the intracellular concentration of mostly a single substance, glycerol. It was demonstrated that the Dunaliella plasma membrane is unique in possessing a very low permeability coefficient for glycerol which is smaller than 10^{-10} cm per second whereas that for other biological membranes is around 10^{-7} cm per second. Large scale cultivation experiments carried out by Koor Foods Ltd. in Israel yielded promising results. (6 figs, 1 tab)

11210 (JSES—602, pp 117-120) **Road test of electric-powered vehicle using solar cells as energy source.** Fujinaka, Masaharu. (Tokyo Denki Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

This paper presents the result of prolonged road test (June, 1985 to July, 1986) of an electric vehicle driven by a lead accumulator charged by the output of solar cells installed on the roof of a residence. The solar cells used are poly-crystalline silicon type cells which have the area as large as four Tatami mats and the output as much as 700 Wp. The main performance of the vehicle reformed from a light car includes the maximum speed of 80 km/h, maximum kilometer per a charge of 110 km, electric motor of 10 kw, thyrister chopper controller with regenerative brake and main battery consisting of 8 cells of 12 V each and 150 Ah. The charging characteristics were examined under four kinds of weather conditions. The vehicle fully charged can travel longer than 20 km of the street on a fine day, several tenth of 20 km on a cloudy day and several kilometers on a rainy day. The average distance covered in a month is 150 km in the rainy season, but 350 km in summer because the condition is better. (3 refs, 7 figs)

11211 (JSES—602, pp 141-144) **Compound uses of solar energy and wind power.** Kanayama, Kimio; Baba, Hiroshi. (Kitami Inst. of Tech., Kitami, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

A test system of a small propeller wind turbine and solar cells in combination was installed on the roof of Kitami Technical College and has been operated since November, 1984. The performance of this test system is calculated based on the experimental data acquired so far while also forecasting the quantities of power generatable in various districts in Hokkaido, referring also to climatic data in situ. Thus, the complementary nature of both systems is evaluated. The particulars of the wind turbine include a rated voltage of 14 V, maximum output of 35 W, optimum solar cell voltage of 16.5 V and a maximum output of 35 W. The test result does not reveal that both systems can function complementarily for a long time, the reasons of which include small mean wind velocity and small quantity of power generated by the wind turbine. The test data is used to simulate the quantity of power generatable in various districts in Hokkaido, using parameters of 11.2% wind turbine efficiency and 7.36% solar cell efficiency. Better complementary effect is seen in seaside cities where there are strong winds. In the hinterland areas, larger dependency on the solar cells is observed. (4 refs, 4 figs, 2 tabs)

11212 **(LBL—24017) Spectroscopic studies of energy transfer in photosynthetic reaction centers of higher plants.** Tabbutt, S. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003850/JAW.

The focus of this thesis is excitation transfer and primary photochemistry in spinach chloroplasts and sub-chloroplast particles. The fluoreacence kinetics are measured with a synchronously pumped, mode-locked dye laser excitation source and a reverse single photon-counting timing detection system. Very little has been reported on the fluorescence properties of photosystem I (PS I) due to its relatively weak emission compared to photosystem II (PS II). Using a PS I complex isolated from spinach, two emission bands, 690 nm and 722 nm were observed. The 690 nm fluorescence kinetics has an instrument limited (25 ps) rise and is best fit to three exponential decay components: slow, 2.2 to 2.5 ns; middle, 250 to 300 ps; and fast, 40 to 100 ps. Both the yield and kinetics are temperature independent (77 to 295K). The 722 nm emission is dramatically temperature dependent. At 295K the fluorescence lifetimes at 720 nm are identical to those at 690 nm. Upon lowering the temperature the lifetimes of all three decay components increase, a measurable risetime (>25 ps) grows in at temperatures below 265K, and the fluoreacence intensity at 722 nm increases about 20-fold from 295K to 77K. These studies provide excitation transfer rates and activation energies within the PS I centers. The PS I emission data can be explained by two Chl a species: an antenna pool emitting at 690 nm and the reaction center emitting at 722 nm. The PSI reaction center complex (CP1) fluorescence intensity under continuous actinic illumination (690 nm) decreased by about 20% with the same kinetics as the optical bleaching at 699 nm. The kinetics and magnitudes of the fluorescence decrease and photobleaching depend upon excitation intensity, ascorbate concentration, ferri/ferrocyanide redox titration and phenasinemethosulfate concentration. 168 refs., 38 figs., 4 tabs.

11213 **(LBL—24123) Photosynthetic oxygen evolution studied by electron paramagnetic resonance and x-ray absorption spectroscopy.** Cole, J.L. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 133p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88002736/JAW.

Photosystem II catalyzes the four electron oxidation of water to O_2. A membrane-bound complex which contains Mn is thought to be the site of O_2-evolution. During turnover, this complex cycles through a series of intermediate states, S/sub i/ (i = 0...4). In this thesis, EPR and X-ray absorption spectroscopy were used to probe the role of several proteins and cofactors in the O_2-evolution reactions. The effects of alkaline pH on the O_2-evolving system were investigated. Two modes of inhibition of electron transfer and O_2 production were revealed. EPR studies revealed that the two types of alkaline inhibition affected electron transfer reactions at different sites. Mechanisms for the reversible and irreversible inhibition are proposed. The flash number dependence of the reduction kinetics of Z^+, an intermediate electron carrier, was studied as a direct probe of charge accumulation at the O_2-evolving complex. Characteristic period four oscillations in the kinetics occurred in active preparations. Upon depletion of the extrinsic proteins, or upon reversible alkaline inhibition, these oscillations were absent, indicating that even partial advancement of the S-states was blocked. Addition of Ca^{2+} and Cl^- reconstituted charge accumulation in some of these preparations. The structure of the Mn complex was investigated in preparations depleted of the extrinsic proteins. The Mn X-ray absorption edge and extended X-ray absorption fine structure (EXAFS) spectra are consistent with an oxo-bridged Mn complex, and are very similar to those obtained in intact preparations. Analysis of these data indicates that the extrinsic proteins do not ligate the Mn. In preparations containing only two Mn, the shape and position of the edge, and the EXAFS spectra are dramatically changed, suggesting that the structure of the complex is disrupted.

11214 **(N—88-10266) Effects of electron and proton irradiations on n/p and p/n GaAs cells grown by MOCVD.** Weinberg, I.; Swartz, C.K.; Hart, R.E. Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. 8p. (NASA-TM—100199; E—3792; NAS—1.15:100199; CONF-871112—). NTIS, PC A02/MF A01.

From 3. international photovoltaic science and engineering conference; Tokyo, Japan (3 Nov 1987).

State-of-the-art n/p and p/n heteroface GaAs cells, processed by metal organic chemical vapor deposition, were irradiated by 1 MeV electrons and 37 MeV protons and their performance determined as a function of fluence. It was found that the p/n cells were more radiation resistant than the n/p cells. The increased loss in the n/p cells was attributed to increases in series resistance and losses in the p-region resulting from the irradiation. The greater loss in fill factor observed for the n/p cells introduces the possibility that the presently observed superiority of the p/n cells may not be an intrinsic property of this configuration in GaAs.

11215 (NEDOJ—501, pp 213-217) **Verification on purification of low-cost silicon for photovoltaic power generation. Development of chlorosilane production technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

As a part of developing low-cost refining process of silicon for solar battery, the development of producing technique of low-cost chlorsilane (TCS) was continued since 1960 till 1982 in designing, producing and testing the method of synthesizing transformation of TCS. This year, based on the result of the research, further advanced tests have been conducted by using a testing device which produces 200 tons of TCS annually, with a result that 1) The production speed will be increased proportionally as fas as the gas speed goes up to 11%, 2) Relationship between the reflux ratio and the impurity-separating performance has been clarified for the purpose of reducing the high cost of the high-quality and high-purity TCS by lowering the purity of the TCS down to that of solar-battery grade, with appropriate steam basic unit, and 3) By testing the effective recovery of TCS in the reacting gas, it went through cyclic hydrogen by using an absorption column, with a recovery of 98.6%. 4) Up to the previous year, there was a problem of solid substance such as aluminum chloride which clogged the tube inlet of water-cooled capacitor in transformation process. This has been improved by flushing the transforming liquid. (2 tabs)

11216 (NEDOJ—501, pp 218-225) **Verification on purification of low-cost silicon for photovoltaic power generation. Development of chlorosilane production by rapid cooling process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

As a part of production development of low-cost silicon for solar-battery, trichlorsilane (TCS) is used. To make its main material of metallurgy-grade of silicon from a domestically available material, it has been tried to use an abundant domestic product of silica sand for making low-cost silicon tetrachloride, and then to apply a hydrogen-reduction to it. For this purpose, four fundamental techniques have been completed: (1) systheais of TCS, (2) separation and recovery, and (3) refining, - these technique being for an

industrialization of the method. Based on the NEDO-commissioning contract, a commissioned testing facility has been designed and constructed, combining the aforesaid three techniques. Namely, (1) for the synthesis of TCS, hydrogen gas as the raw material was boosted and made to react pyrogenetically with gasificated material of tetrachloride (STC), so as to produce the TCS. In the process (2), a solvent was used to separate, and recover uncondensated TCS and generated STC, and for this purpose, it was separated in a separator after having circulated through absorption column, and recovery column. Then the low-boiling content is eliminated through a low boiling content separation column, and the high-boiling content separated through a refining column, so as to obtain a high-purity TCS. (5 figs, 3 tabs)

11217 (NEDOJ—501, pp 226-229) **Verification on purification of low-cost silicon for photovoltaic power generation. Development of production technology of high-purity silica and silicon.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

An approach has been tried for the development of an element technique of making low-cost SOG-Si by refining the low-grade silica sand which can be abundantly produced domestically, and by reducing high-purity silica. The approach is divided into two methods: one is to produce high-quality silica sand by physical method of floatation, magnetic separation, gravity concentration, acid treatment, etc., and the other method is to obtain high purity silica by chemical method of refining the impurities contained therein, by mixing with sodium carbonate, waterglass, acid treatment, etc. Then preparatory experiments have been performed for the purpose of producing the silicon (SOG-Si) of solar-battery grade by applying a high-grade reduction to the obtained high-purity silica: such experiments as obtaining the conditions for the reduction, construction of reduction furnace, materials of the furnace and reduction materials, method of producing the refining pellet, and so forth. (3 tabs)

11218 (NEDOJ—501, pp 230-234) **Verification on purification of low-cost silicon for photovoltaic power generation. Development of chlorsilane hydrogen reduction process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

As a part of development plan for low-cost production of silicon for solar battery, a model plant with annual production capacity of 10 tons of SOG silicon was operated for testing, for the purpose of developing a hydrogen-reduction process of chlorsilane. By collecting data from this operation, element study was made for improvement and higher-qualification of the device for enlargement of the reactor. Starting in 1980 with a small scale testing device with annual production capacity of 0.5 ton, the study has been advanced to operation of an annual 10ton class of model plant. During this period, various improvements have been made including solution of problems such as breakage of the reactor pipe caused by Si deposition thereon, improvement of granule quality and granule extraction, improvement of cleaning device, development of monitoring device for inside of reactor, and so forth. (3 tabs)

11219 (NEDOJ—501, pp 235-242) **Verification on experimental production of solar panel for photovoltaic power generation. Development of cast substrate production process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research work was performed as one of studies funded by NEDO. And the study was intended to obtain data to decrease cost and increase efficiency on energy balance by studying the promotion of efficiency on workmanship and equipment while coordinating the preceding and succeeding manufacturing processes. based on the conventional manufacturing condition of a cast wafer. And on casting technologies, the effect of various factors such as solidifying speed, cooling method, heat treatment, mold configuration etc. was investigated. As a result, it was found that the solidifying speed and thermal history after the solidification had a great effect on a conversion efficiency. On the research and development of a continuous casting furnace an experimental furnace of a fused metal pouring system separating the smelting and solidification was designed and manufactured. The furnace was to manufacture a box style ingot, and simultaneously a graphite mold was developed also. 28 kg of the feed stock was smelted in a quartz crucible, and was poured in a mold with a cross section of 20 cm X 20 cm for solidification. By means of the operation of the furnace a good prospect for the manufacture of a low cost ingot by a large scaled pouring system was obtained. On the processing technology, in an external configuration processing process, by the improvement of the casting technology, the working time per ingot was reduced to the half from about 12 hours to about 5 hours. On the wire, reuse was tried for cost reduction. (8 figs)

11220 (NEDOJ—501, pp 243-245) **Verification on experimental production of solar panel by spin-process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research work was performed as one of studies funded by NEDO. And the study is intended to develop a processing technology on a cast substrate as one of the R/D items of a mass-production line for the solar battery panel. The content of the technical development program is divided to following two items: (1) Development of mold module. (2) Evaluation of characteristics of silicon substrate. On the mold module, to reduce the weight of a transverse mold module, the thickness of the cavity was reduced, and configurative characteristics on the seat were studied, and in consequence, by changing configurations of parts such as screw bolts, the adherence of the lower diah to the cavity was improved and the yield was uprisen. In the meantime, the mass-productivity was studied and by raising the working accuracy on the cavity, the tight fitness of various parts of the mold was achieved. Consequently, the yield on the seat formation was improved. On the evaluation of characteristics of the silicon sutstrate, the measurement of impurities was performed. It was found that impurities separated on the silicon sheet was silicon nitride. Further, SOG silicon was studied, and the washing process was studied as SOG silicone required washing. On various properties such as the fused condition, smelting condition were examined by pouring into a crucible of the smeltery.

11221 (NEDOJ—501, pp 246-251) **Verification on experimental production of solar cell panel. Ribbon crystal wafer process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research work was performed as one of studies funded by NEDO. And the study is intended to develop technologies on the work process of a ribbon crystal substrate, as one of the R/D items of a mass-production line for the solar battery panel. The technical development program was performed on two items, an operation research and an element technology research, and in the operation research, a countermeasure to improve the quality of the ribbon crystal substrate was studied, and an efficiency of 9% for the photo-electric conversion was attained. The content of the research was: (1) High purification of the ribbon crystal substrate. (2) Reduction of SiC particles in the ribbon cystal. (3) Increase of the lifetime of the ribbon crystal substrate. (4) Improvement in flatness of the ribbon crystal substrate. On the element technology research, a development of a new crystal growing technology in which a ribbon crystal with a width of 10 cm may be raised without using a capillary die, and a study on the laser annealing were performed subsequent to the previous fiscal year. The items included in the R/D were as follows: (1) Flattening of the ribbon crystal. (2) Continuous growth and growing speed. (3) Quality improvement of the ribbon crystal. In consequence, the minor carrier lifetime of the ribbon crystal was improved by applying the annealing.

11222 (NEDOJ—501, pp 252-262) **Verification on experimental production of solar cell panel. Wet PN junction process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was funded by NEDO, and intended to develop a dry PN junction process, The technical development program was performed on two themes, an operation research and a process

improvement study. Namely, in the operation research, optimization of the cell manufacturing conditions, and confirmation of the cell quality, characteristics and reliability, were to be performed, and in the process improvement study, based on the result of the preceding year, further improvement was studied for reduction in cost and improvement in quality and characteristics. And in the operation research, the following items were studied: (1) Computer analysis on cell characteristics. (2) Study on new processes. (3) Study on the relationship between the quality of the cast ribbon substrate and the cell characteristics. (4) Experimental manufacture of cells for the centralized system. And as a condition for an experimental manufacture of the cell, top portion of ingot was used in casting because of better substrate guality, and the electrode formation temperature was decreased from 750°C to 700°C, and an optimum cell manufacturing condition such as the thermal diffusion of PN junction forming process was applied. In consequence, the maximum efficiency went up to 11.2% (mean value 10.9%) about 11% higher as compared with the value achieved in the previous year. (3 figs, 4 tabs)

11223 (NEDOJ—501, pp 263-269) **Verification on experimental production of solar cell panel. Panel assembly process technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was funded by NEDO, and intended to develop a wet PN junction process as one of the R/D themes for the mass-production of the solar cell panel. The technical development was performed on an operation research and on work process improvement, and the content is as follows: (1) Operation research: Using various types of low cost silicon substrate, low cost operating condition is to be established as an element working process. (2) Study on work process improvement: For this fiscal year, a better element conversion efficiency as compared with that of connection reflection preventing film coating process by the conventional spin method, and a continuous mass-production are to be made feasible. As for the operation research, respective SOG substrate was received, and the substrate elements completed by a continuous element formation were shipped out for the subsequent process as scheduled. On the SOG cast substrate, about 10,300 sheets of substrate were received, and after the element formation, about 3,300 sheets were shipped out to the module line side. The element characteristics were mostly found as distributed in a range of acout 9.0 - 11.5% resulting in a great improvement in the characteristics. On a study for the work process improvement, an experiment was carried out mainly on a heat treatment effect for the ribbon substrate, and the efficiency increased by about 1.5% by the slow cooling effect. (3 figs)

11224 (NEDOJ—501, pp 270-282) **Experimental production of solar panel. Technological development of panel assembly process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was performed as a part of the studies funded by NEDO. The study is intended to develop the technology of the panel assembly process as a theme for a mass-production line of solar cells. The technical development programs are: (1) Research on cell arrangement and connecting processes (2) Research on panel packaging process (3) Research on inspection process and plant system. The results of the research are as follows: (1) Research on cell arrangement and connecting processes. By manufacturing the actual cell strings, a study was performed to decrease the cost of the lead materials and increase the productivity, and reduction of cost became promising. Further, an operation research (a research throughout the whole process) was performed, and panels were experimentally produced to be supplied to the centrally arranged system using the case and ribbon cells provided from the previous process. A panel conversion efficiency exceeding that obtained in the previous fiscal year was obtained. (2) Study on panel packaging process: Conditions for preliminary and final pressure-fit were reviewed, and the tact-time was reduced by 20% (3) Study on inspection process and plant system: A frameless concept was studied and a rubber frame was selected for the study. As to the wind pressure resistance, a test result was obtained capable of withstanding the wind of 100 m/s. (2 tabs)

11225 (NEDOJ—501, pp 283-285) **Practical application of amorphous Solar cells. Production technology for low-cost monosilane.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was performed as a part of studies funded by NEDO, and is intended to commercialize the production technology to obtain monosilane at a low cost by means of a closed cycle system including the molten salt electrolyte. A test facility with a scale of 10 tons per year was developed, and the work process was improved by performing a long time test operation. The test program was divided into: (1) Study on production of monosilane (2) Study on overall automatic control and efficiency improvement (3) Study to establish an evaluation technology for monosilane. The test results were as follows: (1) Study on production of monosilane: To confirm the result of the improvement and modification of the test production facility, a short time continuous run was performed electrolyzing at the current of 3,000 - 5,000 A, and adjustment, capacity, and other tests were carried out, obtaining the following results: Efficiency of electrolytic current (amount of H_2 absorbed in Li/electrolytic current =about 90%). efficiency of monosilane production (amount of SiH_4 production/electrolytic current = about 90%) (2) Study on automatic control and efficiency improvement: Automation of reproduction process for the absorption tower, improvement tests for the lithium trap, anti-corrosion tests on welding rods for Ni, etc. were carried out. (3) Study on monosilane evaluation technology: Monosilane was evaluated, and a product with a resistance of 200 Ω cm was obtained as compared with the commercialy available pure monosilane having the resistance of 1,000 Ω. (1 fig)

11226 (NEDOJ—501, pp 286-295) **Practical application of amorphous solar cells. High quality production technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was performed as a part of studies funded by NEDO, and was intended to develop a technology to produce amorphous solar cells for power generation with good reproducible property and high sensitivity to solar light, and elucidate the technical and economical feasibility. Following items are included in the technical development program: (1) High quality technology for amorphous semi-conductor production (2) Study on the technology for modular design (3) Study on the electrode formation technology (4) Study on reliability technology. The results obtained by the studies were as follows: (1) High quality technology for amorphous semiconductor production: An amorphous film growing facility of separate and independent reaction type for tandem structure was completed, and optimum film forming conditions for every reaction chamber and an optimum primary step for each mono-layer for the tandem structure were studied. (2) Study on the technology for modular design: Enclosing elements were made by means of film using fluoro-ethyleneпropylene (FEP) as the base material, and weather-proof tests are being carried out. (3) Study on the electrode formation technology: By low temperature film formation - short time annealing, a good result was obtained for the redistribution of impurity and improvement of the processing capacity. (4) Study on reliability technology: A high grade cell with the deterioration rate of the conversion efficiency of less than 2 - 3% was obtained. (4 figs)

11227 (NEDOJ—501, pp 296-299) **Practical application of amorphous solar cells. Large area production technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was performed as a part of studies funded by NEDO, and was intended to develop a production technology for uniform large size cells with little defect. The R/D were performed on the following items: (1) Study on large size a-Si film formation process (2) Study on a large size and low cost transparent electrode formation process (3) Study on large size cells (4) Study on evaluation technology. As a result of these studies, following findings were obtained with priority given to high efficiency technology: Improvements for higher efficiency were centered around the device technology such as development of processing technology

centering around the large size a-Si film formation technology by an IVE type facility, and improvement on p/i interfacial properties. As a result, conversion efficiencies of 11.1% for a 1 cm^2 size cell and 9.1% for a 100 cm^2 cell were achieved. As regards the large size cell, a design technology by distribution constant model was established, and elements were designed to give maximum output for the cell of 600 cm^2 and 1,200 cm^2 size, and an efficiency of about 5% was obtained. For modular design technology, a no cover glass product was studied. (4 figs)

11228 (NEDOJ—501, pp 300-309) **Practical application of amorphous solar cells. Application of high productivity fabrication technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This research was performed as a part of studies funded by NEDO, and was intended to develop a basic technology capable of producing amorphous solar cells efficiently and at high speed, and clarify the technical and economical feasibility. The development was carried out on the following themes: (1) Development of a high speed forming technology of amorphous film (2) Development of recovery technology of raw material gas (3) Development of a high efficient solar cell module production The outline of the study results were as follows: (1) Development of high speed forming technology of amorphous film: The high speed film formation by monosilane and the film formation by silanes of higher order were compared for study, and it was found that the p/i interface property was improved for high applied power if the p layer was formed of disilane instead of monosilane. (2) Development of recovery technology of raw material: It was found that the chiller system was effective to recover the gas discharged from the plasma reaction system efficiently. (3) Development of the high efficient solar cell module production: Development of a patterning technology by the laser system and improvement of the solar cell modules for power generation were taken up. TCO film was used as the substrate, and Ag as the back electrode, and a conversion efficiency of 11.5% was obtained with the size of 1 cm^2. (14 figs)

11229 (NEDOJ—501, pp 310-315) **Practical application of amorphous solar cells. Manufacturing technology of cells with different kinds of substrate (ceramic substrate).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annul Report.

This is a study on the development of manufacturing technology of amorphous solar cells for electric power generation, made as a part of research and development for establishing a technology for the practical use of photovoltaic power generation system to clarify its technological and economic possibilities. (1). A prototype power generation tile was made on a trial basis which had an a-Si power generation element packaged completely by a ceramic substrate at its lower part and by an inorganic coat at its upper part, with a takeout electrode which was the only projection from the cell. (2). Film formation conditions of ceramic/Ti/n-i-p/ITO cell were improved to obtain 8.5% conversion efficiency with a cell having 1 cm^2 area. (3). The decrease in conversion efficiency due to light degradation is mainly caused by deterioration of Jsc and FF. In the case with a cell of thicker i-layer film with 8% initial efficiency, the light degradation can be suppressed to 10%. (4). A film formation method for SiO_2 coating film by plasma CVD technique and photo CVD technique was developed, and a 6 month outdoor exposure test of the cell coating sample was performed. (8 figs)

11230 (NEDOJ—501, pp 316-323) **Practical application of amorphous solar cells. Manufacturing technology of cells with different kinds of substrates (flexible substrate).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a study on the development of manufacturing technology of amorphous solar cells for electric power generation, made as a part of research and development for establishing a technology for the practical use of photovoltaic power generation system to clarify its technological and economic possibilities. 1. A roll film formation method in which amorphous silicon film is formed on continuously running flexible substrates was developed in succession to the previous year. Namely, a technology of roll film formation on the lower electrode and roll ITO film formation was developed to obtain cells of 8.1% conversion efficiency for 1 cm^2. 2. Studies were made on the technologies of optimum modular design for polyester and electrode film formation, and a maskless process applying laser beam processing tchnique, formation of collection electrode film by screen printing method, and maskless integration were investigated. 3. Composite materials of metal frames and butyl rubber/silicon rubber were used for edge sealing required for making flexible substrate solar cell modules. As the result, 100% survival rate was observed in a degradation test of 5,000 hours. (8 figs, 3 tabs)

11231 (NEDOJ—501, pp 324-326) **Research for utilization of amorphous solar cells. Analysis for practical application.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a report on the research for acquiring quick and correct information on technological tendency of amorphous solar cells in Japan and overseas so as to reflect it effectively to support the research and development for practical application of amorphous solar cells for electric power generation. Technological problems related to large size amorphous solar cells for electric power were narrowed down for investigation and analysis. The main items are as follows: (1). Analysis of module cost, investigation on the actual conversion efficiencies, and estimation of future market size concerning a-Si solar cells (2). Problems in connection with attaining higher efficiency and reliability (3). Processing techniques and relating problems (4). Methods of application to manufacturing technology of the results of the basic technology showing rapid progress in the field of a-Si.

11232 (NEDOJ—501, pp 327-330) **Research and development of evaluation system for solar cells.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a research for establishing an evaluation system for solar cells to conduct unprejudiced and proper evaluation tests for the performance of solar cells. Making use of a standard correction unit and a main measurement unit of a large scale solar simulator, a study to improve standard correction accuracy of solar cells was carried out. At the same time, an experimental study was made for the establishment of an evaluation test technology for electric power generation of solar cell modules by means of the standard solar cell process. Using a weather room and temperature and humidity cycle testing equipment, accelerated and natural weathering tests were conducted to analyze the degradation mechanism of solar cell modules. In addition, outdoor exposure tests were performed. Further, to establish the method of testing mechanical strength of the solar cell modules, test machines for hail, torsion and static loads were developed.

11233 (NEDOJ—501, pp 338-350) **Research and development for peripherral technology related to photovoltaic power generation. Basic investigation of electric power generation capacity.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In 1984, basic study of peripheral technology was made as follows to link solar cell systems to electric power systems for actual power generation: 1. As to the estimation method of solar radiation amount on an inclined surface, literature study has been made to logically review the existing methods. In connection with the general estimation formulas of the instantaneous value and monthly average value, the effects of the components of direct solar raditatin caused by daily variation of air mass and the percentage of possible sunshine, and the effects of the components of diffuse solar radiation and reflected global radiation have been elucidated. At the Tsukuba Aerological Observatories, these fluxes of solar radiation were measured precisely and the data were analyzed for a preliminary study on re-evaluation and development. 2. As to the estimation method of flux of solar radiation in mountain districts, research literature is very scanty, but the following results were obtained. The effect of configuration of the ground and natu-

ral features on the earth to the monthly average flux of solar radiation can be estimated by the actual angles of the sun's positions at sunrise and sunset, but they are influenced by the presence of clouds. Also by surveying how the configuration of the ground and natural features at the installation location of the power generation system compart the sky, their effect to the amount of diffuse solar radiation can be estimated. (5 figs)

11234 **(ORNL—6348) Short rotation wood crops program: Annual progress report for 1986.** Ranney, J.W.; Wright, L.L.; Layton, P.A.; McNabb, W.A.; Wenzel, C.R.; Curtin, D.T. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004761/JAW.

This report describes accomplishments in the Short Rotation Woody Crops Program (SRWCP) for the year ending September 30, 1986. The program is sponsored by the US Department of Energy's Biofuels and Municipal Waste Technology Division and consists of research projects at 29 institutions and corporations. The SRWCP is an integrated program of research and development devoted to a single objective: improving the productivity, cost efficiency, and fuel quality of wood energy crops as feedstocks for conversion to liquid and gaseous fuels. SRWCP directives have shifted from species-screening and productivity evaluations to large-scale viability trials of model species selected for their productivity potential and environmental compatibility. Populus was chosen the lead genera of five model species, and initial steps were taken toward organizing a Populus Research Consortium. Production yields from SRWCP research plots and coppice studies are discussed along with new efforts to model growth results and characteristics on a tree and stand basis. Structural and chemical properties of short-rotation intensive culture wood have been evaluated to determine the desirability of species traits and the potential for genetic improvements. Innovative wood energy crop handling techniques are presented as significant cost reduction measures. The conclusion is that new specialized wood energy crops can be feasible with the advances that appear technically possible over the next 10 years. 34 refs., 9 figs., 7 tabs.

11235 **(OTIFBI—87) Forest research 1983-1985.** Gillmeister, D.; Bates, D. (eds.). (Ontario Tree Improvement and Forest Biomass Inst., Maple (Canada)). 1987. 99p. (MICROLOG—87-04860). Ontario Tree Improvement and Forest Biomass Institute, RR #2, Maple, Ont., Canada L0J 1E0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

There has never been so much emphasis on forestry or a need for first-class forest management. It usually takes several generations to grow trees to harvestable size, and forest managers must cope with weather, fire, insects and disease. Dramatic shifts in consumer demand mean changes in the type and quality range of products. Only research can provide this much-needed information in an organized, timely and cost effective manner. Research achievements have provided new understanding in ecology, site classification, tree improvement, nursery practices, and silviculture. Widely used practices include the Brohm Seeder, the TRIM system and a comprehensive forest ecosystem classification system. Current work is in genetics, biotechnology, physiology and silviculture. These projects promise to provide great help to forest managers to shorten rotations, increase yields, and improve the quality of an important natural resource.

11236 **(PAI—8702) An overview of achievements in bioenergy research, development, and demonstration.** (Passmore Associates International, Ottawa, Ontario (Canad)). Feb 1987. 119p. (MICROLOG—87-04144). Bioenergy Development Program. Renewable Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

As part of an overall strategy to promote innovations in the field of renewable energy, Energy, Mines and Resources is offering financial assistance for selected research, development, and demonstration (R,D&D) projects in bioenergy. In Canada, traditional biomass conversion methods are being re-examined and new processes developed. The Bioenergy Development Program is playing a key role in the emergence of bioenergy technologies by assisting Canadian industries to develop new and better systems and equipment. Bioenergy encourages self-sufficiency and helps protect Canadians from potential oil supply disruptions and price fluctuations. Canada is fortunate in having a varied, abundant biomass resource base on which to build a future in bioenergy technologies. While forests are the greatest source of biomass, other important sources include agricultural residues, municipal and industrial process wastes, peat and aquatic biomass. The Bioenergy Development Program has identified six priority areas within their R,D&D program: materials preparation and handling, direct combustion, conversion to liquid fuels, conversion to gaseous fuels, conversion to chemical feedstocks, and environmental considerations. This document provides an overview of Canadian accomplishments in the field, assessing both the status and potential of the various technologies.

11237 **(PB—88-107867/XAB) Biomass and volume tables for Eucalyptus camaldulensis, Dalbergia sissoo, Acacia auriculiformis, and Cassia siamea in the central Bhabar-Terai of nepal. Occasional paper.** Hawkins, T. (Oxford Univ. (UK). Commonwealth Forestry Inst.). 1987. 46p. (OFI/OP—33). NTIS, PC E05/MF E05.

In Nepal there is a very clear and well-documented shortage of fuelwood which affects everyone from the isolated hill farmer to the urban householder and the small-scale industry. During the last five years, several forestry projects have been developed with the purpose of establishing high-yielding short-rotation fuelwood plantations to supply firewood to local industry and urban centers. Other community forestry projects aim to encourage Terai villagers to grow their own fuelwood and fodder trees on private and communal land. The purpose of this paper is to produce preliminary biomass and volume tables of the four most important Terai plantation species for use in estimating the early yield of short-rotation plantations, and to measure the actual field precision and validity of the equations.

11238 **(PB—88-107875/XAB) Forest management research study in the broadleaf middle-hill forest of Nepal. Occasional paper.** Thompson, I.S. (Oxford Univ. (UK). Commonwealth Forestry Inst.). 1986. 72p. (OFI/OP—30). NTIS, PC E06/MF E06.

The forest resource of the middle hills and factors (related to ecology, demand and implementation) which affect the choice of silvicultural options for it are given to provide a context for the description of the trials set up to date as part of the management research program of the Nepal-UK Silvicultural Research Project. The procedures for the research in Schima-Castanopsis forest are given. Results of the initial measurement of the standing crop, its treatment and in one case its remeasurement are given. It is concluded that given adequate protection the trials can provide important information on the effects of the different silvicultural options on the quantity and distribution of forest products which will be of practical benefit to the forest manager.

11239 **(PB—88-119599/XAB) Bulletin of the Electrotechnical Laboratory, Vol. 49, No. 2, 1985.** (Electrotechnical Lab., Sakura, Ibaraki (Japan)). 1985. 114p. NTIS, PC E06/MF A01.

Table of contents of this special issue include SnO_2/n-Si solar cells; Copper precipitates characterizing lattice imperfection in EFG ribbon silicon; Minority-carrier diffusion length of EFG silicon ribbon solar cells; Diffusion length measurement by using an MIS structure under light irradiation; Short-circuit current measurement of silicon solar cells; New analysis method of error in short-circuit current measurement; Reference-cell method for calibration of polycrystalline silicon cells with the spectral response shift; Stability of irradiance of Xe-lamp-type solar simulators; Photo-induced changes in amorphous silicon and their effect on solar cell performance; Infrared absorption measurement on amorphous silicon; Growth of a-Si:H by low-frequency glow-discharge decomposition of SiH_4.

11240 (PB—88-130026/XAB) Energy transfer and photochemistry in biomimetic solar conversion. Annual report, October 1986-September 1987. Boxer, S.G. (Stanford Univ., CA (USA). Dept. of Chemistry). Sep 1987. 16p. NTIS, PC A03/MF A01.

See also report for Oct 1985-Sep 1986, PB—87-134060.

Electron transfer is being studied in several well-defined molecular systems, and new techniques for studying electron transfer are being developed. Photo-induced electron transfer lies at the heart of photosynthesis and forms the basis for the approach to biomimetic solar conversion. Electron donors and acceptors are covalently connected to molecular frameworks, which permit variation of the distance between sites and the nature of the intervening medium. Myoglobin produced by recombinant DNA methods was modified to place a free sulfhydryl group at various positions on the surface for attachment of electron acceptors. Surface histidine residues are modified with Ru-reagents. Electron donors and acceptors were also attached to double-helical DNA as a first approach to polymer-based donor/acceptor systems. The effects of applied electric fields on the absorption and emission spectra (Stark-effect spectra) of compounds undergoing electron transfer were studied. The Stark-effect spectra of several Ru-complexes were obtained, from which the authors can extract quantitative information on changes in the permanent dipole moment between the ground and excited state. The authors have also shown that, under certain conditions, the electric field can change the rate of electron-transfer reactions, and that the effect is easily detected in the electric-field-modulated fluorescence spectrum. These effects were demonstrated for bacterial reaction centers and certain Ru-complexes.

11241 (PNL—5699) Bench-scale studies on gasification of biomass in the presence of catalysts. Mudge, L.K.; Baker, E.G.; Brown, M.D.; Wilcox, W.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 124p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003860/JAW.

This report summarizes the results of bench-scale studies on the development of catalysts for conversion of biomass to specific gas products. The primary objective of these studies was to define operating conditions that allow long lifetimes for secondary catalysts used in biomass gasification. Nickel-based catalysts that were found to be active for conversion of wood to synthesis gases in previous studies were evaluated. These catalysts remained active indefinitely in laboratory studies but lost activity rapidly when evaluated in a process research unit. Bench-scale equipment was designed and installed to resolve the differences between laboratory and PRU results. Primary catalysts (alkali carbonates) were also evaluated for their effectiveness in improving conversion yields from biomass gasification. 21 refs., 27 figs., 19 tabs.

11242 (SAND—87-2035C) A comparison of different module configurations for multibandgap solar cells. Gee, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 10p. (CONF-871114—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002718/JAW.

From 8. SERI photovoltaics advanced research and development project review meeting; Denver, CO, USA (15 Nov 1987).

The use of different module configurations with multijunction (MJ) solar cells was investigated. Module configuration refers to the electrical circuit in which the subcells of the MJ cell are connected. The simplest configuration has the subcells connected in series. The subcells may also be connected in parallel or operated independently. These circuits require MJ cells with more than two terminals. The performance of two-junction tandem cells with the different module configurations was analyzed by means of computer modelling. Roughly the same performance was found for an optimized MJ cell with the different module configurations. However, several advantages for MJ cells with the subcells wired in parallel as opposed to series were identified, including wider selection of bandgaps for optimal performance, less sensitivity to spectral variations, and possibly less sensitivity to radiation damage.

11243 (SERI/PR—231-3258) FY 1987 Aquatic Species Program overview. Johnson, D.A.; Sprague, S. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1987. Contract AC02-83CH10093. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001112/JAW.

The goal of the Department of Energy/Solar Energy Research Institute (DOE/SERI) Aquatic Species Program is to develop the technology base to produce liquid fuels from microalgae at prices competitive with conventional alternatives. Microalgae are unusual plants that can accumulate large quantities of oil and can thrive in high-salinity water, which currently has no competing uses. The algal oils, in turn, are readily converted into gasoline and diesel fuels. The best site for successful microalgae production was determined to be the US desert Southwest, with potential applications to other warm areas. A technical and economic analysis, Fuels from Microalgae, demonstrated that liquid fuels can be produced from mass-cultured microalgae at prices that will be competitive with those of conventional fuels by 2010. Aggressive research is needed, but the improvements required are attainable.

11244 (SERI/SP—231-3206) FY 1987 Aquatic Species Program: Annual report. Johnson, D.A.; Sprague, S. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1987. Contract AC02-83CH10093. 269p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88001111/JAW.

The goal of the Department of Energy/Solar Energy Research Institute Aquatic Species Program is to develop the technology base to produce liquid fuels from microalgae at prices competitive with conventional alternatives. Microalgae are unusual plants that can accumulate large quantities of oil and can thrive in high-salinity water, which currently has no competing uses. The algal oils, in turn, are readily converted into gasoline and diesel fuels. The best site for successful microalgae production was determined to be the US desert Southwest, with potential applications to other warm areas. Aggressive research is needed, but the improvements required are attainable. The four prime research areas in the development of this technology are growth and production, engineering design, harvesting, and conversion. Algae are selected for three criteria: tolerance to environmental fluctuations, high growth rates, and high lipid production. From 1982 to 1986, the program collected more than 3000 strains of microalgae that are more than twice as tolerant to temperature and salinity fluctuation than the initial strains. Productivity has been increased by a factor of two in outdoor culture systems since 1982, and lipid content has also been increased from 20% of body weight in 1982 to greater than 66% of body weight in 1987. Research programs are ongoing in lipid biochemistry and genetic engineering so that ultimately strains can be modified and improved to combine their best characteristics. An outdoor test facility is being built in Roswell, New Mexico.

11245 Evaluation of spray-drying methods for cellulase preservation. Himmel, M.; Oh, K.; Tucker, M.; Rivard, C.; Grohmann, K. (Solar Energy Research Institute, Golden, CO 80401, USA. Solar Fuels Research Div.). *Biotechnology and Bioengineering Symposium;* No. 17, 413-423(1986). (CONF-860508—).

From 8. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1986).

Spray drying processes are widely used for the large-scale preservation of biology goods. The application of this technology to the enhancement of the storability of cellulase and related enzymes would improve fermentation processes requiring input of specific quantities of enzyme catalyst of known activity. Very high percentages (90% of original) of filter paper and carboxymethyicellulose hydrolyzing activities can be recovered from conventional spray dryers when operated at inlet air temperatures ranging from 90 to 180 degrees. The beta-glucosidase and beta-xylosidase activity recoveries were somewhat lower and were optimal at temperatures ranging from 120 to 150 degrees. However, the individual performance of the 12 enzyme preparations examined was quite preparation specific. An ultrasonic nozzle adaptation to the Yamato dryer demonstrated the overall feasibility of high energy atomization inasmuch as the filter paper activity was retained after drying. The more labile beta-xylosidase activity was, however, entirely lost.

11246 **Progressing batch hydrolysis reactor single-stage experiments.** Bergeron, P.; Wright, J.D.; Werdene, P.J. (Solar Energy Research Institute, Golden, CO 80401-3393, USA). *Biotechnology and Bioengineering Symposium;* No. 17, 33-51(1986). (CONF-860508—).

From 8. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1986).

Hydrolysis of aspen wood chips using a single percolation reactor at 185 degrees hydrolysis temperature, 0.5 weight percent sulfuric acid, and 30-minimum liquid residence time produced a 55% glucose yield (dry, hydrous basis) and a 7.8-g/L glucose concentration. Yields compare favorably with those from other researchers. Sugar concentrations are low but are expected to increase with feedstock size reduction and prehydrolysis condition changes.

11247 **High temperature acid hydrolysis of biomass using an engineering - scale plug flow reactor. Results of low testing solids.** Brennan, A.H.; Hoagland, W.; Schell, D.J. (Solar Energy Research Institute, Golden, CO 80401, USA). *Biotechnology and Bioengineering Symposium;* No. 17, 53-70(1986). (CONF-860508—).

From 8. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1986).

An engineering-scale experiment at the Solar Energy Research Institute investigating dilute acid hydrolysis of lignocellulosic biomass using a 3.8-cm (1.5-in) diameter plug flow to 900 kg/h (2000 lb/h) at 200-260 degrees and 4-20 seconds residence time. Initial experiments operated with 10 weight percent solids slurries to verify that yields obtained in bench-scale experiments could be maintained at a larger scale. The results of these tests can serve as a baseline for research addressing prehydrolysis of the slurry, high solids pumping, pretreatment requirements, and fermentability.

11248 **Dilute acid pretreatment of biomass at high acid concentrations.** Grohmann, K.; Torget, R.; Himmel, M. (Solar Energy Research Institute, Golden, CO 80401, USA. Solar Fuels Research Div.). *Biotechnology and Bioengineering Symposium;* No. 17, 135-151(1986). (CONF-860508—).

From 8. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1986).

The dilute acid pretreatment of biomass (aspen wood and wheat straw) at high solids concentrations (up to 40 weight percent) has been investigated. It produces a concentrated monomeric soluble sugar stream (mainly xylose) with little degradation of the available sugars and a solid residue containing cellulose and lignin. The cellulose remaining in the residue from both aspen and straw pretreated at either 140 degrees or 160 degrees was highly digestible with commercial available enzymes. A somewhat higher acid consumption for wheat straw compared with that for aspen can be alleviated by a cation-removal step.

11249 **Determination of useful lifetime of immobilized beta-galactosidase for hydrolysis of lactose in permeate obtained from ultrafiltration of cottage cheese whey.** Scott, T.C.; Hill, C.G. Jr.; Amundson, C.H. (Oak Ridge National Lab., Oak Ridge, TN 37831, USA. Chemical Technology Div.). *Biotechnology and Bioengineering Symposium;* No. 17, 585-590(1986). (CONF-860508—).

From 8. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1986).

Beta-galactosidase immobolized on a porous silica carrier was used to effect the hydrolysis of lactose in permeate that results from the ultrafiltration of cottage cheese whey. Results obtained from analyzing kinetics of the immobilized enzyme have led to the formulation of a model that can be used to assess catalyst performance when utilizing a specified reactor operating strategy. The model predicts a lifetime of 90 days for the catalyst bed when starting production at 30 degrees and maintaining a constant production rate by raising the operating temperature as a function of time-on-stream. The useful lifetime of the catalyst was not significantly affected by the extent of lactose conversion carried out in the reactor. This model has the potential for use in optimization of reactor operating conditions for industrial applications of the immobilized enzyme.

11250 (UCRL-Trans—12193) **Fluorescent collectors.** Stahl, W.; Zastrow, A. Translated from *Physik in Unserer Zeit ;* 16: 167-179(1985). Contract W-7405-ENG-48. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001643/JAW.

For several years concentration of solar radiation with fluorescent collectors has been investigated. These collectors do not operate according to the principle of optical imaging but instead can be compared better with a heat engine. They are capable of increasing the specific work capacity (exergy portion of energy) of the incident radiation for which purpose low temperature heat (anergy) must be dissipated to the environment. For this reason fluorescent collectors can also concentrate diffuse light (solid angle 2π or even 4π) almost exactly as well as direct light, and they are not subject to any theoretical concentration limit. This article gives a survey of the status of research and development work on fluorescent collectors, where basic questions of physics will be discussed along with the possible applications of the system in practice. 1 ref., 15 figs., 2 tabs.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 11271, 13709

11251 (CSTB-ECTS—86-458) **Roof integration of photovoltaic system.** Chevalier, J.L.; Filloux, A.; Lyonnet, C.; Suno, S. (Centre Scientifique et Technique du Batiment, 75 - Paris (France)). Oct 1986. 76p. (In French). NTIS (US Sales Only), PC A05. Order Number DE88751711/JAW.

To facilitate the penetration of photovoltaic systems in the building environment, many experimental roof-integrated installations have been built in Germany, France or USA. The purpose of this work was to provide specific design rules for photovoltaic panels integration. Regarding to the thermal aspects for different integration conditions (insulation, inclination...) the monitoring of an experimental installation provided measurements which were used to drive governing correlations between the cell temperature and environmental conditions. Regarding to the mechanical aspects and weathertightness of the roof, many specific mounting design rules and electricity safety requirements were set up. Two specific photovoltaic applications are presented; they were developed with industry.

11252 (JSES—602, pp 1-4) **Study on the effect of geographical shade to photovoltaic power generation system.** Chinen, Masanori; Koseki, Shoichiro; Saishoji, Toshiya. (Hitachi, Ltd., Tokyo, Japan; Electric Power Development Co., Ltd., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The effect of mountain shade must be studied although the photovoltaic power generation system is expected to be hopeful as a power supply to isolated land. An evaluation program with contour lines is developed and applied to an example of Shintoyone Dam, in Aichi prefecture because conventionally available programs for urban area are not appropriate for complicated geology. In a time zone where a small radiation area ratio is involved, both solar radiation quantity and glass face transmission ratio are small. In addition, a proportion of sky solar radiation quantity, not influenced by mountain shade, is as large as 50-60% to total sky radiation quantity. Accordingly, only a reduction of 4% to 9% is expected in winter compared to summer, for the effective accumulation of solar radiation quantity (available for electric output) on the lake with mountain shade. Therefore, the photovoltaic power generation system may be installed in satisfactory efficiency even at a location relatively narrow and surrounded by steep mountains. (4 refs, 7 figs, 1 tab)

11253 (JSES—602, pp 125-128) **Cost analysis of photovoltaic power generation system.** Okubo, Hajime; Horigome, Takashi. (Tokyo Univ. of Agriculture and Tech., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Aiming at showing the goal and direction of research and development of photovoltaic power generation system, cost analysis and economic evaluation of two systems of noncollective stationary type and collective tracking type are made. The economic evaluation is based on the basic concept that the total revenue of generated power is equal to the total expense adjusted by the inflation rate and indirect cost. In the stationary type photovoltaic power generation system alternative to the diesel power generation system, it is at present most important to raise the modular conversion efficiency up to approximately 13% and reduce the modular cost to 380 - 420 Yen/Wp or less. It is effective for the reduction of the power cost to reduce the cost of fringe equipment to 150 - 200 Yen/W. It is desirable to develop a tracking type solar cell module showing the conversion ratio of approximately 22% and a power cost of 460 - 560 Yen/Wp. (6 refs, 5 figs, 1 tab)

11254 (JSES—602, pp 129-132) **Optimum designing method of household photovoltaic power generation system.** Kawakami, Kaneyuki; Hirayama, Yasushi; Segawa, Yosuke; Yamamoto, Shinya; Ishihara, Yoshiyuki; Todaka, Toshiyuki. (Doshisha Univ., Kyoto, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The operational characteristics of household photovoltaic power generation system were calculated using the generated power and load pattern data for one year. The optimum designing method of the power generation system was investigated from the time ratio of changing mode of every switch, ratio of excessive power, ratio of excessive power to supplied power and total annual power rates. The rate of potential energy of battery at every hour was obtained from the calculated generated-power and load pattern at every hour and the annual operational characteristics were simulated changing the switch. The simulation result of a household power generation system of the average consumption of electricity of 300 kWh/m indicates that the optimum system design meeting the requirements can be made even changing the average consumption of electricity and system efficiency. (3 refs, 5 figs, 4 tabs)

11255 (NEDOJ—501, pp 331-337) **Research and development of peripheral technology related to photovoltaic power generation.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a report on the research and development of peripheral technology for incorporating solar cells into an electric power system to carry out practical generation of electricity. As for clarification of problems when linked to electric power system, 5 sets of 2 - 5 kW practical systems were constructed and installed to constitute a small 21 kW total power generation plant with the existing 2 sets put togeter. This system was linked to the test distribution lines at the Akagi Test Center (6 km in total length) to conduct field tests on linkage cooperation with the electric system, operation methods, etc. The test enabled comprehensive experiments and study in the future. As for optimum system, based on the study results in the past, a 2 - 5 kW system was designed and manufactued for the study of an optimum system, and basic data for designing the optimum system were accumulated. In addition, measurement of long term reliability of photovoltaic power generation system and related evaluation methods were studied. (1 fig, 1 tab)

11256 (NEDOJ—501, pp 351-357) **Photovoltaic power system for single family houses.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In 1984, systems for individual residence have been developed to establish the application technology of solar cells. 1. By changing the capacities of storage batteries in turn for no load, one day load, and two day load, and operating the individual residence system with the load pattern of an average family and the load pattern slided to daytime, it has been found that a one day battery capacity is not sufficient, but capacities of two days or more are not efficient. If the capacity is sufficient, the ability of the system is not affected by the differnece of the load pattern. 2. The operating data of the preceeding year were used to make a computer program for global radiation on an inclined surface for analysis, and it has revealed that the upper limit of the solar energy percent is 88%. If the capacity of storge battery is sufficient, the effects of the difference of load patterns to the solar energy percent is small. 3. Costs of elemental equipment and installation have been investigated and it has been estimated that a unit system cost for the lot of 1,000 units will be 1/3 of the present cost (10 units per lot). 4. The voltage fluctuation and harmonic distortion factor at the point connecting the systems were measured, with the result of less than 1 % for the former and less than 2% for the latter. (4 figs, 2 tabs)

11257 (NEDOJ—501, pp 358-366) **Photovoltaic power system for collective housings.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In 1984, to establish the application technology of solar cells, a system for a group of residences have been operated for verification as follows: 1. From the viewpoint of improvement of system efficiency, using the data obtained in the preceeding year, the optimum system including output control devices of solar cells, charge and discharge control devices, invertors and loads has been investigated. Verification test operation of a partially improved system has been made for the loads of 8 - 23 residences, and the evaluation of applicability of the system and the optimum designing methods have been investigated. 2. The operation data of photovoltaic power generation have been collected and the optimum structure of the system was investigated. The results are as follows: (1) There was no power failure caused by photovoltaic power generation system during the 2 year operation and possibility of stable continuous operation was assured. (2) Yearly amount of possible power generation is estimated to be about 16,000 kW which can supply stable power to 8 houses. (3) Judged from the observation of electric load fluctuations with the individual and group of residences, the pattern is assured to be standard and the capacities of the invertors for a group of 20 residences can be reduced to 1/3 of that for the individual residence. (4) Average 80 - 85% inverter efficiency and 41 - 45% system efficiency have been achieved. From these results, the optimum designing method of the system for a group of residences to meet the solar radiation and meteorological conditions have been obtained by simulation. (4 figs, 3 tabs)

11258 (NEDOJ—501, pp 367-377) **Photovoltaic power system for school buildings.** Aug 1985. NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In 1984, to establish the application technology of solar cells, systems for schools have been developed The machining Center of the Tsukuba University was selected as the load, and a verification operation of the existing 100 kW system has been performed. In addition, the composition of 200 kW system has been investigated, and a software program has been developed which analyzes and processes on line through a system data collector and outputs tables and graphs. An optimum system was worked out whcih reduced the interval of the periodical recording to 10 seconds and improved the precision of analysis of operation data. 100 kW solar cells of multicrystal and single crystal types have been formed into 151 arrays. 12 modules have been connected in series to equal the floating charging voltage of storage batteries, and the deviation of short circuit current in the same array and the deviation of open voltage between arrays have been made tp less than constant values. Also the frames of solar cell arrays and frame bases have been studied for light-weight and low costs. 100 kW equipment was added to make a 200 kW system, and power failure-prooof of direct current control circuit, partial modification to direct current type of failure detecting circuit, addition of time lag short circuit timer of the output of solar cells, and protective methods for connection to high voltage wires have been investigated, and elemental devices were

studied and devloped for the improvement of the control methods of DC/AC convertor and so on. (4 figs)

11259 (NEDOJ—501, pp 378-385) **Photovoltaic power system for factories.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In 1984, to establish the utilization technique of solar cells, a system for factories has been developed A 100 kW class system was classified into an electric power system and measurement system, and function of every device was checked, establishing the total system. Although the start-up was as per the plan, it revealed that the start time was delayed by about 30 minutes from the scheduled time due to initial charging of line. A variety of loads were combined with or without storage batteries and verification operations have been carried out to collect and analyze various data. Daily average of the amount of generated electric powr was about 300 kWH, and the average generated amount of electric power during working hours of the plant was about 230 kWH, equivalent to about 75%. It was learned that the efficiency of devices, utilization rate of the system, the power generation rate, and solar energy percent were close to the designed values. The design of an optimum array system was studied using a mini-system, and the output of solar cells has been evaluated. In the case of no scattered light, the incident energy becomes maximum at the angle in which the direct solar radiation becomes perpendicular to the inclined surface, and reduces with the increase of scattered lights. For tracking maximum point of incident energy, it became clear that in one axis tracking, north-south axis should be fixed while tracking in the east-west direction, and in two axis tracking, maximum output points should be tracked in accordance with the ratio between direct and scattered lights, and not with the sun. (6 figs, 3 tabs)

11260 (NEDOJ—501, pp 386-393) **Stand-alone photovoltaic power system for mountainous areas.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Research was started in June, 1984 as a new development item. A practical design was made for the actual building based on a conceptual design for the system for either mountainous or remote area. The building was of mountain-hut style at Ohyama-cho, Shinkawa-Gun, Toyama prefecture (floorage: 105.58 m^2). An energy supply system was composed by fixing a 5 KW solar cell on the roof of the building. And basic problems for an optimized independent and decentralized system were analyzed, (3 figs)

11261 (NEDOJ—501, pp 394-401) **Stand-alone photovoltaic power system for desalination of sea-water on remote islands.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

A town of Kishima, Fukue City, Nagasaki Prefecture, was for the site of the sea-water desalination plant utilizing an independent and decentralized solar power generation system, through a study from both solar power generation and sea-water desalination. This system is an independent system which operates by DC power obtained by a solar cell receiving energy from the sun light. Simulation on the power output was made in consideration of the elevation of solar cell temperature and the reduction of power output due to the surface contamination, and, of course, considering the amount of the sun light received. Simulation on the desalinated water production was made based on the preceding simulation. Average annual water production was roughly 32 m^3/d (maximum, 65 m^3/d). Specification of the total system is as follows: Solar cell capacity: 25 KWp, Capacity of desalination :10 m^3/d, power system : DC 100V. (3 figs, 2 tabs)

11262 (NEDOJ—501, pp 402-416) **Stand-alone photovoltaic power system for power supply of remote islands.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Aza area, Zamami-mura, Zamami-Shima, Okinawa Prefecture was selected for the plant site. The power load was rated at 14 private houses, one low pressure water pump, and a pair of outdoor lamps. Average monthly power consumption was set at 3,139 KWH based on the past measurement. Total amount of the solar power generation element awas rated as 50.7 KWp and the inverter capacity as 45 KVA. DC parallel circuit was adopted for the diesel generator. Power output was simulated for estimating the surplus power. As a result it was found that 264 V battery voltage was optimum for the optimal working voltage of 300 Vop of the solar power peneration element, and that the power generation loss due to the disparity with the optimum action point at this moment was in the range of 1.5 - 4 %. Annual loss of power generation due to the shadow of sun light was estimated as less than 1 % in case the array frames were placed 3 meters apart. Method of operation and monitoring method of the storage battery were examined for the effective utilization of the solar energy and for minimizing the working hours of the diesel generator. AC-DC conversion system adopted was a transistor PWM type. A salt-proof design and a measure for the wind were adopted although any lightening arrestor was not installed.

11263 (NEDOJ—501, pp 17-424) **Stand-alone photovoltaic power system for off-shore use.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This system was installed on the off-shore of Kamino-Ura, Oita prefecture for the investigation of a solar cell module suited in the sea environment and of the composition of the solar cell. Concerning the solar cell module on the sea surface, means to reinforce the resistance against the waves and salt were examined. Results of the system simulation are as follows: a) The solar cell is to be horizontally installed, and matching between the annual power output and power consumption of the load is to be maintained. b) Capacity of the solar cell should be 10 KWp. c) Suitable capacity for the storage battery is 1,000 AH. d) Annual total power output was at the level of 9,500 KWH. Calculation of power output was made for the case of circularly installed frames inclined outward in order to reduce the contamination of the light-receiving surface of the solar cell. It was found that the inclination of up to 10 degrees was permissible when 2 % reduction of power output was allowed in comparison with the horizontal installment. Barges and mooring units of the solar cell stand and the supporting frame of the solar cell were developed. The barge was round and made of concrete, and the chain-mooring was adopted.

11264 (NEDOJ—501, pp 425-438) **Stand-alone photovoltaic power system. Methane gas hybrid system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Haruyama hog raising center in Kagoshima City was selected as a site for this hybrid system. The center consists of a fattening center, a breeding center, and two water pumping stations. The system installed here is a hybrid of solar power generation and methane gas power generation which are supplementary to each other. Electricity generated by the solar cell is supplied to the daytime load wherein the excess power is fed to the storage batteries. Methane gas power generation is feasible only for 6 hours a day due to the limited methane generation. Methane gas unit is operated at night when the power supply from the solar cell unit is off. Electricity from the methane unit is fed to the storage battery and simultaneously to the night-time load via an inverter. In case the storage battery gets short of the capacity because of the long spell of bad weather, the remaining power is primarily secured for the indispensable load. Maxmum output of the solar cell is 30.24 KWp. Rated output of the methane gas unit is 30.2PS. (10 figs)

11265 (NEDOJ—501, pp 439-448) **Stand-alone photovoltaic power system. Lumber energy hybrid system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objectives of the research and development are the application of solar power generation systems backed up by lumber power generation systems to sanitariums located in mountains and forests, economical efficiency and operability, and the establishment of an optimum planning method to be applied to similar facilities. In 1984, a public facility in Shizuoka Prefecture was selected for

the investigation of meteorological and environmental conditions, and the study was made on output voltage, input voltage, system efficiency and economical maintainability, and a basic system configuration was established. It was determined that the load for the power was 15 kWh/day, and the storage battery requirement was at least for 3 days. Lumber power generation was adopted for the backup system since it is suitable from the viewpoints of fuel, environmental pollution, waste disposal, utilization of waste heat, and promotion of the development of local industries. About 1kW was determined as most suitable for the lumber power generation system to back up the electric load of 15 kWH/day. The conceptional structure of the system comprises solar panels set at the angle of 25°, 5kWp solar cells, 1 kW backup solar power generation system, 5 kVA A/D conversion equipment, and storage batteries with 175 kWH capacity. (6 figs)

11266 (NEDOJ—501, pp 449-459) **Centralized type photovoltaic power generation system. Study on dispersed array type.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objective is to establish a dispersed array type photovaltaic power generation system to expand the application area of solar power generation. In 1980, a basic design of a system which would operate with existing electric power facilities was worked out. In 1981, 25 and 50 kW systems and conceptional supervision and control devices were designed. In 1982, the systems were connected to the load in the factory with additionally installed systems, and their cooperative operation started. In 1983, new equipment was added to complete a 100 kW system, and a partial demonstration tests were carried out. In 1984, the systems were operated continuously for 8 months, and the characteristics of the electric power generation were elucidated with the results of solar battery efficiency of 6%, inverter efficiency of 85%, system efficiency of about 5%, power generation of 49,000 kWH for the 8 months, etc. Plural solar power generation systems were completed, and basic studies on fluctuation of voltages, distribution of harmonic components, and stability of control, etc. were made. Devices were added further to complete a 200 kW system, and tests using the system were inaugulated.(7 figs)

11267 (NEDOJ—501, pp 460-468) **Centralized type photovoltaic power generation system. Study on centralized array type.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objective is to establish a centralized array type photovoltaic power generation system to expand the application area of solar power generation. In 1980, a basic design of the system and the yearly schedule for the research and development were worked out. In 1981, detailed design of the system was prepared, and 20 kWp solar cells and the measuring equipment for the solar cell output characteristics were installed in Saijoh City. In 1984, trial operation of the system, designing, construction and traial operation of a 600 kW class solar power generation system were carried out, and the resulting data were measured and anyalysed. As regards the system, detailed design of the system supervision and control devices and a 400 kW inverter, circuit design for 1,400 kWh storage batteries, design of the frames for solar arrays, installation and investigation of the automatic array washing device, design of load simulation equipment were made, and a 600 kW class power generation system was completed. In the analysis made with the system, it was learned that the yearly mean of sunshine duration was 9.5 hours, and the efficiency of the array was improved to 8.2% from 7.7%. In addition, charge and discharge properties and DC power collection characteristics of storage batteries, detection of inferior solar cells, anti-lightning characteristics of the amorphous solar cells, and weather forecast were studied. (6 figs, 3 tabs)

11268 (NEDOJ—501, pp 469-473) **Centralized type photovoltaic power generation system. Environmental study on water-surface installation.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objective is to work out a conceptual design to study the feasibility of the power generation system installed on a water surface. In 1982, rivers, lakes and marshes, and dams were investigated, and items related to environment and laws were also studied. In 1983, power generating capacities of dams were estimated, and documents were studied about the project's possible impact to environment. Inland waters applicable for water-surace installation were divided into 3 categories, i.e., dams, reservoirs, and lakes and marshes. The applicability is about 40%. A variety of floating bodies were studied and simulated. It is found that solar modules meeting NEDO's specifications can be used for water-surface installation when sealing agent at the ends of modules are carefully finished. As to electric systems, 2 methods were studied, i.e., installing the inverter on the floating body and setting the inverter on land. As regards power transmission, both AC and DC systems were studied. Construction costs, problems relating to installation on ocean were also studied.

11269 (NEDOJ—501, pp 474-484) **Development of solar-thermal hybrid type photovoltaic power generation system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objective of the technological development is to develop and study the photovoltaic and thermal hybrid type solar electric power generation system. Since a preliminary study was made in 1974, trial production and operation had been made for solar concentration elements, consentrator, and concentration equipment. In 1980, a 6 kWp class system was installed, and overall operation tests were made for a 30 kWp system in 1981 and 1982. In 1983, the hybrid unit, driving unit of the solar tracking device, hybrid control device and inverter were improved, and their functioning data were collected and analyzed. In 1984, data of weather conditions, power generation, heat collection, inverter, hot water supply, air conditioning, energy balance, etc. were collected and analyzed, and the optimization of the system was studied using equations related to the obtained data. Unattended long term operations were carried out which proved that the system is sufficiently reliable and useful. During the operation coupled with commercial power source systems, stable power was supplied. An inverter control system suitable for office level load was developed which enabled high efficient operation of average 85% during operation and 70% as the yearly mean. As to the heat collection system, it was proved that cooling was possible as well as heating. The result of a simulation in which the operation data were used provided indices for the optimum hybrid type solar thermal electric power generation system. As regards the design of heating system, it was confirmed that the optimum components can be worked out by simulation. (3 figs, 2 tabs)

11270 (NP—8750995) **Solar village Indonesia: Picon - Cituis - PUSPIPTEK. Final report. Phase II: Implementation. Phase III: Test and operation.** Noetzold, H.; Ohrt, U.; Pitzer, H.L.; Schmidt, P.; Schwenke, J.; Budiono, C.; Lubis, A.; Witono; Suharta, N.; Witjaksono, H.A. (Technischer Ueberwachungs-Verien Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz). 1986. 300p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88750995/JAW.

On the basis of the agreement of cooperation in scientific research and technological developemnt concluded between the governments of the Republic of Indonesia and the Federal Republic of Germany, the Solar Village Project was carried out by BPP Teknologi and TUEV Rheinland. This joint research project on utilization of solar energy and biomass, lasting from 1979 until 1984, was carried out in three phases: Phase I: Definition (February 1979 - September 1980, not part of this report); Phase II: Implementation (October 1980 - December 1982); Phase III: Test and operation (January 1983 - December 1984). The project was divided into three main items: Field tests in the rice farmers' village Picon; field tests in the fishermens' village Cituis; research, test and scientific work in PUSPIPTEK the National Center for Research, Science and Technology at Serpong. The main technical systems installed on site are: Main power plants, desalination plants, ice making plants, rice processing plants, photovoltaic power plants, biomass conversion plants, solar heat pumps.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 11354

11271 (JSES—602, pp 121-124) **Evaluation of performance of orbital photovoltaic power generation.** Kondo, Shigeki; Hara, Tetsuo. (Kyocera Corp., Kyoto, Japan; Taisei Corp., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

A non-collective single-axis tracking power generator was studied aiming at increasing the generated power output and steadily controlling the power supply. The power generating performance was qualitatively evaluated investigating the comparison between the measured power output generated by the practical generator and the simulated value of the solar radiation gained and considering the component of diffused radiation and solar spectrum. The schedule of regular operation of tracking system was decided by determining the relationship between the time of the maximum flux of solar radiation and the angle of rotation of every 10° based on the simulation result of gained solar radiation according to the Bouguer and Berlage's equation using the pitch of revolving axis as the calculation condition. It was found from the ratios of gained energy to the tracking and stationary systems that the gained energy is maintained more stably by the tracking system than by the stationary system. The significant relationship between the component of diffused solar radiation and the tracking efficiency was confirmed by the measured result of direct solar spectrum. (2 refs, 6 figs, 2 tabs)

11272 (NEDOJ—501, pp 485-497) **Development of solar thermal power plant. Management and analysis of a pilot plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

A pilot plant for testing solar thermal power generation was constructed in 1981 for the purpose of research and development of solar thermal power generation systems. It was at Nio in Kagawa Pref. It was run for investigation from September, 1981 to March, 1984. Two plants were installed: one was based on curvature collection and the other was based on tower collection. Either was studied while being run. The major point in operating a solar thermal power plant is reduction of heat radiation loss. In this sense, the operation of the heat storage is important. The capacity of the heat storage has proved to be at least the value corresponding to a generator power of 1000 kW-hour. This paper evaluates the performance of both the curvature-collection and tower-collection based plants. The evaluation items include the quantity of incident solar radiation, the quantity of generated steam, the generated power, and the relationship among them. Evaluation was made using equations obtained through statistical investigation. The percentages of the power generation time, the heat storing time, plant halt time during the day, and the plant halt time at night on a day are also evaluated. In addition, the heat radiation loss is evaluated.

11273 (NEDOJ—501, pp 498-524) **Development of solar thermal power plant. Study on distributed receiver system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In the investigation conducted while running the Nio pilot plant aimed at research and development of solar thermal power generation systems, this paper focuses on the development of the curvature-collection based plant. What is reported here includes the simulation performed to evaluate the operational characteristics of the plant, an outline and features of the curvature-type solar collector, the composition and characteristics of the developed selective absorption surface and selective transmissive film, the type, heat storage material, and performance of the developed heat storage, and the results of the operation tests on the pilot plant. The results of the operation tests include the confirmation of the performance of the light collecting, heat collecting, and heat storage systems. The paper also discusses the development of a future solar power plant. The reports on this future plant include the features of the light solar collector developed since 1981, the proposal of an apparent-heat dissolution heat storage, an outline of the test-elaborated small general testing equipment, rough design of a 10 MWe plant and investigation on its operation, and an outline of cost evaluation on a future solar thermal power plant. (7 figs, 10 tabs)

11274 (NEDOJ—501, pp 525-537) **Development of solar thermal power plant. Study on central receiver thermal power generation.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In the investigation conducted while running the Nio pilot plant aimed at research and development of solar thermal power generation systems, this paper focuses on the development of the tower-collection based plant. The paper reports the yearly development progress, and outlines the results of the investigation, focussing on the following: an outline of the system determined as a result of simulation, the performance of the heat absorber, the techniques for designing the heliostat and improving its tracking accuracy, the performance of the heat storage, proposal of an apparent-heat type storage, an outline of the results of elemental investigation on materials, an evaluation on the results of measurement of incident solar radiation, and considerations on development techniques. During the development, a scale-up scheme based on decomposition and assembly was adopted consistently, and 1,100 kW plant, nearly a practical plant, was constructed only through elemental investigation and simulation. However, this scheme involved problems concerning difficuties in selecting appropriate elements and evaluating the influence of each element on the entire system. The possible measures for cost reduction include the use of a larger and lighter heliostat, generation of higher-pressure, higher-temperature steam, and optimization of the plant configuration. (8 figs, 11 tabs)

11275 (NEDOJ—501, pp 538-551) **Solar system technology for industry. Study on a cascaded heat process system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

A dying process was selected as a typical industrial process requiring stepwise temperature control, and an optimum energy system utilizing solar heat stably and efficiently in order to reduce the consumption of auxiliary energy to a minimum was developed. The development started in 1980, and ended in 1982 when the system was installed. The activities performed for research and development include testing of the high-temperature solar collector for its heat collecting efficiency and durability, the development of a popular type high-temperature solar collector, and the development of technology for optimal operation control. The test-elaborated solar collector is based on an existing general vacuum-tube type, but incorporates a reflecting mirror for light collection. Software was developed for optimal operation control. This paper also discusses the monitor run in 1983, an outline of the operation instructions, and the processes for installing the equipment. (7 figs, 1 tab)

11276 (NEDOJ—501, pp 552-574) **Solar system technology for industry. Study on a fixed heat process.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

A constant-temperature warehouse was selected as a typical industrial process requiring thermal control for always keeping a constant temperature, and a constant-temperature warehouse system utilizing solar energy stably and efficiently in order to reduce the consumption of auxiliary energy to a minimum was developed. This paper reports the yearly development progress from 1980 to 1984 for each of the development elements. The reported items include the developed constant-temperature warehouse system assuring proper heat balance and control based on a thermal load computation program, the construction plan, the foundation work, the employed equipment, including the absorption refrigerator, solar collector, heat storage, and dehumidifier, the measuring system, the simulation program, the items and results of the tests, and the operation achievement. The principal equipment is as follows: a large, high-performance solar collector integral to the roof (682 m^2), an absorption refrigerator utilizing solar heat (32,000 kcal/ hour), a

temperature-laminated heat storage tank (75 m^3), two dry-type dehumidifiers utilizing solar heat (3 kg/hour each), various measuring apparatuses, a data collector, and automatic control equipment. The warehouse is kept at a temperature of 15°C and a relative humidity of 50% or less. The load over the total energy consumption = 0.281; the load over the auxiliary fuel energy consumption = 1.199. (8 figs, 3 tabs)

11277 (NEDOJ—501, pp 575-582) **Solar system technology for industry. Study on high-performance refrigerating system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The result of survey on the conventional solar energy utilization system and on the refrigerated ware house tells that the former is not yet commercialized. Concerning the latter, design and simulation were made, by assuming the scale (C_3 class) of about one half of the average accommodation capacity per plant in the past ten years, in the combination of a solar heat collector with 500 m^2 area and refrigerating capacity of 45,000 kcal/h (brine outlet temperature being -7 °C). A heat collector was trially made and test-operated for obtaining 140 °C which was necessary for the drive of an absorption refrigerator. It was found probable to attain the heat-collecting efficiency of 50 %. Basic design and the drawings were prepared for the five systems (heat collector, absorption refrigerator, refrigerating ware house, back-up system, in strument system) for a refrigerating ware house. with 194.4 m^2 floor area, 3 m effective ceiling height, and 580 m^3 accommodation. (5 figs, 2 tabs)

11278 (NEDOJ—501, pp 583-601) **Solar system technology for industry. Study on underground heat storage system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a NEDO contracted project. Three types of tanks were used in this equipment for the underground heat-accumulating water tank. Externally insulated square tank, internally insulated square tank, and non-insulated round tank. Depth of tanks was 12 m. Heat accumulation lasted 3 month (from Dec. to Feb. next year). Heat recovery operation was made in March. The efficiency of heat recovery was rather low as 23.6 %, but considerable improvement in the recovery can be estimated if a limiting temperature for recovery is lowered below 15 °C by utilizing a heat pump. Heat loss from the water surface decreased down to half when heat-insulating foamed polystyrene balls of 5 cm diameter were spread in 10-15 cm thickness in the tank. This method is very good as an heat insulation of the water surface in the underground tank. A PC well method was verified to have merits of high accuracy, short construction time, water-sealing, and water-proofness. (16 figs, 1 tab)

11279 (NEDOJ—501, pp 602-621) **Solar system technology for industry. Study on a chemical reaction type heat storage system as long term heat storage technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is a contracted NEDO project. (1) According to the research made with a bench-scale heat-accumulating tank (with 10 Mcal scale) which was trially made in 1984, Lm-Ni alloy (Lm: a mixed metal containing much La) for a heat-accumulating tank and La-Nd-Ni alloy for a hydrogen-absorbing alloy were selected. (2) Heat-accumulating tank could be accurately simulated from the three characteristics of a) overall heat transfer coefficient between the reacting alloy and the heat medium, b) heat capacity of the tank, and c) overall heat transfer coefficient of heat loss. A favorable result was obtained for an attached heat pump when a mixture of hydrogen-absorbing alloy and aluminum fibre was filled in a gap of aluminum fins. (3) Heat loss at the operation test of the heat-accumulating tank was 15 %. Recovery was over 70 % even when the level of the heat recovering temperature was raised by 10 °C. (15 figs, 1 tab)

11280 **Integrated heat pipe-thermal storage system performance evaluation.** Keddy, E.; Sena, J.T.; Merrigan, M.; Heidenreich, G. (Los Alamos National Lab., NM). pp 183-187 of IECEC '87; Proceedings of the Twenty-second Intersociety Energy Conversion Engineering Conference, Philadelphia, PA, Aug. 10-14, 1987. Volumes 1, 2, 3, & 4. New York, NY; American Institute of Aeronautics and Astronautics (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

An integrated thermal energy storage (TES) system, developed as a part of an organic Rankine cycle solar dynamic power system is described, and the results of the performance verification tests of this TES system are presented. The integrated system consists of potassium heat-pipe elements that incorporate TES canisters within the vapor space, along with an organic fluid heater tube used as the condenser region of the heat pipe. The heat pipe assembly was operated through the range of design conditions from the nominal design input of 4.8 kW to a maximum of 5.7 kW. The performance verification tests show that the system meets the functional requirements of absorbing the solar energy reflected by the concentrator, transporting the energy to the organic Rankine heater, providing thermal storage for the eclipse phase, and allowing uniform discharge from the thermal storage to the heater.

1408 Ocean Energy Systems

11281 (CL—NRCC/27191) **Monitoring of a heat pump to energy recovery and process temperature control.** Kaneps, M. (Orlic (A.) and Associates, Halifax, Nova Scotia (Canada)). Mar 1986. 332p. (MICROLOG—87-04565). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This reports on the development and implementation of a heat pump monitoring program detailing the application and adaptation of standard commercial heat pump equipment for the extraction and use of themal energy from ocean source seawater along Canada's Atlantic Coast. The specific application was a lobster holding facility owned by Clearwater Lobsters Limited of Halifax, Nova Scotia. Examination of the daata indicated the heat pump system could extract and use thermal energy at or near initial design conditions. The lobsters were able to be held at consistently lower temperatures which improved product quality and reduced shrinkage. Influx of seawater debris, marine growth, and dryland pound heat gain were indentified as the only major problems. The information gathered from the monitoring study indicated that heat pump systems can be adapted to extract and utilize thermal energy from ocean source seawater. 50 figs., 123 tabs.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 11270, 11701

11282 (CSTB-ECTS—358) **Study of solutions to obtain the French LABEL HAUTE PERFORMANCE ENERGETIQUE and LABEL SOLAIRE.** Buscarlet, C. (Centre Scientifique et Technique du Batiment, 75 - Paris (France)). Oct 1985. 32p. (In French). NTIS (US Sales Only), PC A03. Order Number DE88751709/JAW.

The object of the study is to evaluate how to get the Label Solaire with a solar water from a solution of the Label HPE. The study shows how the subsidies attached to the Label Solaire can cover the cost of the solar water heater.

11283 (ETEC—87-7) **Quality site seasonal report, Fort Devens Launderette, SFBP [Solar in Federal Buildings Program] 1751, December 1984 through June 1985.** Logee, T.L. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003625/JAW.

The active solar Domestic Hot Water (DHW) system at the Fort Devens Launderette was designed and constructed as part of the Solar in Federal Buildings Program (SFBP). This retrofitted system was one of eight systems selected for quality monitoring. The purpose of this monitoring effort was to document the performance of quality state-of-the-art solar systems in large federal buildings. The launderette is part of the Post Exchange complex at the Fort Devens Army Post in Fort Devens, Massachusetts. The solar system preheats hot water for the coin operated laundry which has an estimated 25,000 customers per year. There are 108 collector panels comprising the 2563-square foot collector array. Collected solar energy is stored in a 3800-gallon tank. Propylene glycol is used to protect the solar array from freezing. Two immersed heat exchangers provide heat transfer from the propylene glycol to directly heat the DHW supply water in the storage tank. Auxiliary energy is supplied by gas and oil boilers. This solar system can be considered one of a kind and as such is a prototype. The lessons learned from building and operating this system should be used to correct design deficiencies and improve the performance of future solar systems for this application. Highlights of the system performance at the Fort Devens Launderette solar system during the December 1984 through June 1985 monitoring period are presented in this report.

11284 **(ETEC—87-8) Quality site seasonal report, Tucson Job Corps Center, SFBP [Solar in Federal Buildings Program] 1751, November 1984 through July 1985.** Logee, T.L. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 186p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003624/JAW.

The active solar Domestic Hot Water (DHW) system at the Tucson Job Corps Center was designed and constructed as part of the Solar in Federal Buildings Program (SFBP). This retrofitted system is one of eight of the systems in the SFBP selected for quality monitoring. The purpose of this monitoring effort is to document the performance of quality state-of-the-art solar systems in large Federal buildings. The systems are unique prototypes. Design errors and system faults discovered during the monitoring period could not always be corrected. Therefore, the aggregated overall performance is often considerably below what might be expected had similar systems been constructed consecutively with each repetition incorporating corrections and improvements. The solar collector system is installed on a two story dormitory at the Job Corps Center. The solar system preheats hot water for about two hundred students. The solar system provided about 50% of the energy needed for water heating in the winter and nearly 100% of the water heating needs in the summer. There are about 70,000 gallons of water used per month. There are seventy-nine L.O.F. panels or 1659 square feet of collectors (1764 square feet before freeze damage occurred) mounted in two rows on the south facing roof. Collected solar energy is stored in the 2200-gallon storage tank. The control system is by Johnson Controls. City water is piped directly to the storage tank and is circulated in the collectors. Freeze protection is provided by recirculation of storage water. There is an auxiliary gas fired boiler and 750 gallon DHW storage tank to provide backup for the solar system. Highlights of the performance monitoring from the solar collection system at the Tucson Job Corps Center during the November 1984 through July 1985 monitoring period are presented in this report.

11285 **(ETEC—87-9) Quality site seasonal report, Homestead Launderette, SFBP [Solar in Federal Buildings Program], November 1984 through June 1985.** Pakkala, P.A. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88003516/JAW.

The active solar system at Homestead Launderette provides solar preheated domestic hot water for the Launderette (Building 495). This retrofitted system is one of eight systems selected for quality monitoring as part of the Solar in Federal Buildings Program (SFBP). The purpose of this monitoring effort is to document the performance of quality state-of-the-art solar systems in commercial applications. These systems are unique prototypes. Design errors and system faults discovered during the monitoring period could not always be corrected. Therefore, the aggregated, overall performance is often considerably below what might be expected had similar systems been constructed consecutively with each repetition incorporating corrections and improvements. The Launderette at Homestead AFB serves the laundry needs of the personnel at the base. The base is located in Homestead, Florida which is approximately 40 miles south of Miami, Florida. The laundry is expected to accommodate 15,000 customers per year for an approximate load of 531 million Btu per year, or 44.3 million Btu per month. The solar system was designed to supply 68% of the DHW load. The closed loop collector array has a gross area of 1475 square feet of Energy Transfer Systems flat-plate collectors. Solar energy is stored in two 1000-gallon storage tanks where it can be used to preheat DHW. An in-line propane-gas-boiler will provide auxiliary energy according to its desired setpoint. Also, a recirculation loop was included in the design to maintain a constant distribution temperature at all times. Highlights of the system performance at Homestead Launderette during the November 1984 through June 1985 monitoring period are presented in this report.

11286 **(ETEC—87-10) Quality site seasonal report: Army Air Force Exchange Service Headquarters Building, SFBP 1343, August 1984 through May 1985.** Pollock, E.O. Jr. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 217p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88003475/JAW.

The active solar Domestic Hot Water (DHW) system at the HQ Army-Air Force Exchange Service (AAFES) Building was designed and constructed as part of the Solar in Federal Buildings Programs (SFBP). This retrofitted system is one of eight of the systems in the SFBP selected for quality monitoring. The purpose of this monitoring effort is to document the performance of quality state-of-the-art solar systems in large federal building applications. The six-story HQ AAFES Building houses a cafeteria, officer's mess and club and office space for 2400 employees. The siphon-return drainback system uses 1147 ft^2 of Aircraftsman flat-plate collectors to collect solar energy which is used to preheat domestic hot water. Solar energy is stored in a 1329-gallon tank and transferred to the hot water load through a heat exchanger located in the 356-gallon DHW preheat tank. Auxiliary energy is supplied by two gas fired boilers which boost the temperature to 130°F before it is distributed to the load. Highlights of the performance of the HQ AAFES Building solar system during the monitoring period from August 1984 through May 1985 are presented in this report.

11287 **(ETEC—87-11) Quality site seasonal report, Gainesville Job Corps Center, SFBP [Solar in Federal Buildings Program] 5009, December 1984 through June 1985.** Raymond, M.G. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003627/JAW.

The active solar Domestic Hot Water (DHW) and Space Cooling (SG) system at the Gainesville Job Corps Center was designed and constructed as part of the Solar in Federal Buildings Program (SFBP). This retrofitted system was one of eight systems selected for quality monitoring. The purpose of this monitoring effort was to document the performance of quality state-of-the-art solar systems in large federal building applications. These systems are unique prototypes. Design errors and system faults discovered during the monitoring period could not always be corrected. Therefore, the aggregated, overall performance is often considerably below what might be expected had similar systems been constructed consecutively with each repetition incorporating corrections and improvements. The Job Corps Center (JCC) located in Gainesville, Florida, is used for training underprivileged youths in a variety of useful trade and industrial skills. The solar energy system at the JCC supplements space cooling and domestic hot water (DHW) needs for the 18,000 ft^2 single-story building. The basic occupancy of this building is from 7 A.M. to 5 P.M. Monday through Friday, 12 months a year. The solar system has 192 Owens-Illinois evacuated tube collectors with a gross area of 6144 square feet. Solar energy is stored in a 3000 gallon storage tank. Solar energy from storage is supplied to a 1500-gallon DHW preheat tank through a heat exchanger in the storage tank, and directly to a 25-ton ARKLA chiller. Auxiliary energy for DHW is supplied by an LP gas burner. There is normally an electric chiller for auxiliary space cooling, but none was in place at the time the solar system was monitored. Highlights of the performance at the Gainesville

Job Corps Center during the period December 1984 through June 1985 are summarized in this report.

11288 **(ETEC—87-12) Quality site seasonal report: Cherokee Indian Hospital, SFBP 4058, December 1984 through April 1985.** Raymond, M.G. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 175p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88003474/JAW.

The active solar Domestic Hot Water (DHW) and space heating system at the Cherokee Indian Hospital was designed and constructed as part of the Solar in Federal Buildings Program (SFBP). This retrofitted system is one of eight of the systems in the SFBP selected for quality monitoring. The purpose of this monitoring effort is to document the performance of quality state-of-the-art solar systems in large federal building applications. The hospital serves the Qualla Reservation of the Cherokee Indian Tribe in Cherokee, North Carolina, near the eastern entrance to the Great Smoky Mountain National Park. Solar energy is used to preheat domestic hot water (the cafeteria is the principal load) and for space heating. The hospital is expected to have a normal year-round occupancy of 200 people (patients, medical and maintenance personnel) with some 2775 expected visitors per year. The drain-back solar system has 320 Owens-Illinois evacuated-tube collectors with a gross area of 5517 square feet. Solar energy is stored in a 6335-gallon storage tank. Solar energy from storage is supplied to a 700-gallon DHW preheat tank through a heat exchanger in the storage tank, and directly to heat exchangers in the heating ducts. Auxiliary energy is supplied by two large oil-fired boilers. Performance of the system at the Cherokee Indian Hospital during the period December 1984 through April 1985 are reported.

11289 **(ETEC—87-13) Quality site seasonal report, Eisenhower Museum, SFBP [Solar in Federal Buildings Program] 4008, March 1985 through September 1985.** Raymond, M.G. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003544/JAW.

The active solar Domestic Hot Water (DHW) and space heating system at the Eisenhower Museum was designed and constructed as part of the Solar in Federal Buildings Program (SFBP). This retrofitted system is one of eight of the systems in the SFBP slected for quality monitoring. The purpose of this monitoring effort is to document the performance of quality state-of-the-art solar systems in large federal building applications. These systems are unique prototypes. Design errors and system faults discovered during the monitoring period could not always be corrected. Therefore, the aggregate, overall performance is often considerably below what might be expected had similar systems been constructed consecutively with each repetition incorporating corrections and improvements. The solar system is a retrofit, designed to supply part of the space heating (and reheating for humidity control) load at the museum, located at President Eisenhower's boyhood home in Abilene, Kansas. The small DHW load is also served by the solar system. The museum and adjacent library entertain approximately 200,000 visitors per year, and require controlled temperature and humidity for preservation of artifacts. The summer reheating load for humidity control is comparable to the space heating load in winter. The solar system has 110 US Solar flat plate collectors with a gross area of 4201 square feet, using ethylene glycol as the collector fluid. The energy from the collector loop is transferred to two 1980 gallon storage tanks via an external heat exchanger. Solar energy is used for DHW preheating and for space heating. Highlights of the performance monitoring at the Eisenhower Museum during the period March 1985 through September 1985 are summarized in this report.

11290 **(ETEC—87-14) Quality site seasonal report, National Agricultural Library, SFBP [Solar in Federal Buildings Program] 9011, August 1985 through October 1985.** Logee, T.L. (Vitro Corp., Silver Spring, MD (USA)). 15 Oct 1987. Contract AC03-76SF00700. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003626/JAW.

The active solar cooling and heating system at the National Agricultural Library was designed and constructed as part of the Solar in Federal Buildings Program (SFBP). This retrofitted system is one of eight of the systems in the SFBP selected for quality monitoring. The purpose of this monitoring effort is to document the performance of quality state-of-the-art solar systems in large Federal buildings. These systems are unique prototypes. Design errors and system faults discovered during the monitoring period could not always be corrected. Therefore, the aggregated, overall performance is often considerably below what might be expected had similar systems been constructed consecutively with each repetition incorporating corrections and improvements. The National Agricultural Library is part of the US Department of Agricultural Research Center located in Beltsville, Maryland. The solar system was designed to supply 5% of the annual heating and cooling load. There are 200 Sunmaster evacuated tube panels in the collector array with a gross area of 5314 square-foot. These panels are built with six-foot evacuated tubes, model TRS-81. A drainback configuration with a water heat transfer medium is used. The 5000 gallon storage tank has 3800 gallons in it when drained back and 2800 gallons during operation. Solar energy is provided to the heating load by two heat exchangers, the 120°F secondary system and the 180°F radiant system. Solar cooling is provided by an ARKLA 25-ton solar heated absorption chiller. The solar heating and cooling systems are controlled by a Honeywell Excel microprocessor system. Auxiliary heating is provided by three gas-fired boilers and auxiliary cooling is provided by two large centrifugal chillers. Highlights of the performance of the National Agricultural Library solar system during the monitoring period from August 1985 through October 1985 are presented in this report.

11291 (JSES—601, pp 169-172) **Operated results of fully electrified solar house USH.** Udagawa, Mitsuhiro. (Kogakuin Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A02. Order Number DE88770031/JAW.

In Advanced utilization of solar energy. Utilization for biotechnology.

Practical operated results of fully electrified solar house of two stories and total floor area of 164 m^2 which was constructed by steel frames and light aerated concrete facing, were reported. Room heating was made by heat storage floor where the solar heated water passed through concrete slabs and surplus heat was used to supply hot water. When surplus heat was deficient to supply hot water, the hot well employing midnight power was used. Supplementary heating was made by heat pump air conditioners equiped to each room. Supply water was heated in summer by the solar heat and the hot well and the rate of solar heat utilization was 64% and this rate in winter dropped to 25% because the almost all solar heat was used to heat rooms. Heat loss was 33% in summer and 31% in winter and it is desirable to improve heat efficiencies of the hot water tank and the hot well. (4 refs, 5 figs, 1 tabs)

11292 **(JSES—601) Advanced utilization of solar energy. Utilization for biotechnology.** (Japan Solar Energy Society, Tokyo). Dec 1986. 5p. (In Japanese). NTIS (US Sales Only), PC A02. Order Number DE88770031/JAW.

Practical results of a fully electrified solar house of two stories are reported.

11293 (JSES—602, pp 25-28) **Result of cooling operation of solar cooling/heating system using single- and double-effect absorption cooling/heating water facilities.** Oshiro, Tooru. (Yazaki Corp., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The effect of the capacity of heat storage tank on the system performance of the solar cooling/heating system provided with single- and double-effect absorption cooling/heating water facilities of the air-conditioning capacity of 52,510 to 109,850 kcal/h was investigated in the cooling operation varying the capacity of heat storage tank in the order of 6 m^3, 3 m^3 and 1 m^3. For the office buildings where the cooling load is concentrated in the day time, the utilization efficiency is more improved with reducing the capacity of heat storage tank. This is, therefore, effective for the economics and reduction of investment cost. The capacity of heat storage

tank can be reduced as far as air is not sucked in the drain pipe of the collector. Since the heating load seems to be concentrated in the morning and evening different from the cooling load, the capacity of heat storage tank must be carefully investigated. (3 refs, 6 figs, 4 tabs)

11294 (JSES—602, pp 29-32) **Experiment of heat pump system utilizing solar heat radiative cooling.** Ito, Sadasuke; Miura, Naokatsu. (Ikutoku Technical Univ., Kanagawa, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

The performance of the heat pump system using a plate panel provided with finned tube of excellent convective heat-transfer and the effects of wind load, atmospheric temperature, solar radiation and radiative cooling on the coefficients of performance of the heat pump cycle and refrigerating cycle at a constant temperature of circulating water were examined. The results indicate that the collector of excellent heat-transfer used as the evaporator of heat pump can easily absorb the ambient heat. The effect of solar radiation is higher in low velocity of the wind, while it is lowered in high velocity of the wind because the convective heat-transfer is increased. Since the radiative cooling at night is relatively small, the effect is generally low though it is expected to be high in remarkably low velocity of the wind or using a large radiator for the system equipped with the radiator used as the condenser of refrigerating cycle. (6 refs, 10 figs, 1 tab)

11295 (JSES—602, pp 33-36) **H_2O-CH_3OH-LiBr-$ZnCl_2$ system absorption refrigerator.** Iyogi, Shigeki; Nakanishi, Masato; Uemura, Tadashi. (Kansai Univ., Osaka, Japan; Takasago Thermal Engineering Co., Ltd., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of 12th symposium of Japan Solar Energy Society.

The coolant mainly composed of absorbent system of H_2O-LiBr for the absorption refrigerator is practically used. This system has, however, various shortcomings in applying to the absorption refrigerator using low-temperature heat source. Since the H_2O-LiBr system is hardly cooled by air, a system incorporated with $ZnCl_2$ is prepared to increase the range of solubility and a tetra-component system incorporated with CH_3OH is prepared to make the operation at an evaporation temperature of 273.15°K or under possible. The physical and thermal features of the system are measured to draw the diagram of enthalpy-concentration. The performance and operating characteristics of the system are examined in single- and double-effect absorption refrigerators using the system. The system is considered possible to apply to air-conditioning and refrigeration as well as air-cooling operation utilizing low-temperature heat source. (11 refs, 7 figs, 3 tabs)

11296 (JSES—602, pp 65-68) **Performance characteristics of volumetric receiver type solar air-heater using glass-tube bundle.** Itaya, Yoshinori; Matsui, Hirohito; Kaya, Masanobu. (Nagoya Univ., Nagoya, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

A volumetric receiver type solar air-heater was manufactured on an experimental basis to enhance the heat transfer by increasing the receiving area and apparent optical thickness of air phase in which glass-tube bundle is packed as the optical semi-permeable medium. This solar air-heater is a new type that the heat stored in the packing compensates the intermittent solar heat. The field test was carried out in such a way that air is continuously passed through the glass tubes by a blower to examine the characteristics of heat absorption and storage comparing with the plate type collector. The efficiency of heat absorption is approximately 25% higher than that of the plate type and the outlet temperature of air is stable even by the temporary change of solar radiation and 15 to 20°C higher than that of the plate type. The pressure loss is so small that the viability is recognized. (3 refs, 9 figs, 1 tab)

11297 (JSES—602, pp 85-88) **Study on cascade type underground thermal storage solar heating system in Tehran.** Nakajima, Yasutaka; Kaabi-Nejadian, A.; Ito, Sachio. (Kogakuin Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The conventional thermonuclear long-term underground thermal storage solar heating system packed with latent heat storage material in Tehran was improved by preventing the cascade operations of the heat pump units and direct heating hot-air fans from interfering each other and by enhancing the heat recovery rate from the soil. The improved system was simulated. The results obtained in Tehran were compared with those obtained in Tokyo. The collecting efficiency and the heat recovery rate significantly depend upon the surface area of collector and the operating time of heat pumps, respectively, in Tehran. The relationship of the surface area of collector with the heat recovery rate shows the same trend and the heat recovery rate from the soil increases with increasing of the operating time of heat pump in both Tehran and Tokyo. The interference of the heat pumps and direct heating hotair fans is prevented and especially the operation of heat pump is effective for effectively using the thermal characteristics of the storage and dissipation of heat in the soil. (3 refs, 4 figs, 10 tabs)

11298 (JSES—602, pp 137-140) **Effective use of solar in snowy district.** Anno, Tsunetomo. Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

This paper presents the experimental results in FY 1985 of melting the snow piled on the street using solar energy in Yonezawa City (latitude: approx. 37.9°, latitude: approx. 140.1° and altitude: approx. 255 m) selected as the experimental site. The experiment was carried out varying the amount and temperature of water poured into the snow piled on the ten-add experimental sections with different materials and dimensions of pavement and piping, depths of underground pipe, configuration of piping and colors of street. Expressing the effect of flux of solar radiation on the saved energy in melting the snow as the effective degree showing the percentage of flux of solar radiation consumed for melting the snow to the total, it is estimated 30 to 50%. The value of design standard of the energy required for melting the snow is 100 W/m^2 or less. The power which can be used as hot water is approximately 100 times the power used for the operation. Approximately 60 to 75 kWh/m^2 can be obtained in the favorable section. (4 refs, 5 figs, 6 tabs)

11299 (JSES—602, pp 145-148) **Study on evaluation of passive solar house.** Nakajima, Yasutaka; Ohashi, Kazumasa; Kasuya, Kouji; Mochizuki, Shintaro. (Kogakuin Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Thermal performance of the passive solar house is studied while proposing an evaluation graph that quantitatively shows the thermal performance in terms of the quantities of collected heat, stored heat and transmitted heat and daily difference of room temperatures. A relationship of heat storage vs. thickness of heat insulation is calculated based on the result of simulation with a heat insulation material of concrete. Quantity of heat dissipation can be predicted referring to the relationship between heat storage and dissipation in fine days using the simulation model. The evaluation graph can be created only with the data of room temperature, surface temperature on the inner wall of the room and solar radiation quantity. The graph can also be created by measured data, perhaps effective in view of practical application. (6 refs, 11 figs, 1 tab)

11300 (JSES—602, pp 149-152) **Experimental study on thermal performance of base floor using passive solar system test house.** Ishikawa, Yoshimi; Hasegawa, Fusao; Yoshino, Hiroshi. (Tohoku Univ., Sendai, Japan Tohoku Inst. of Tech., Sendai, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Using a wooden house consisting of 2 test rooms, the thermal performance of base floor is studied in a configuration with a concrete base floor (room A) and a brick floor and wall (room B). Various data are shown including room temperatures in room A and B, daily mean underground temperature, variation of total solar radiation quantity on horizontal plane, comparison of temperature variations in both rooms and comparison of mean temperatures and their variations. The quantities of heat dissipated from both rooms become smaller in summer, particularly room B yielding smaller quantity of heat storage. Mean heat storage and dissipation in room A are 68% and 43%, respectively, of those in room B. The quantity of heat stored throughout the period is 60% larger than heat dissipation. Heat stored in room B is closely related to the quantity of transmitted solar radiation, i.e., a mean ratio of 85% recorded for radiation quantity vs. heat storage. Room A shows smaller increase of heat storage radiation quantity than room B, while being affected more significantly by season. (3 refs, 10 figs, 1 tab)

11301 (JSES—602, pp 153-156) **Study on using solar energy for semi-underground room (Part 3). Long-term test and calculation results under transmitted solar radiation.** Matsumoto, Shin'ichi; Hasegawa, Fusao; Yoshino, Hiroshi. (Tohoku Univ., Sendai, Japan Tohoku Inst. of Tech., Sendai, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Natural room temperature and underground temperature are measured where the heat insulation shutters are removed while introducing solar radiation into the test room. The natural room temperature and load of the semi-underground room are calculated by changing weather conditions and soil types. The application of horizontal heat insulation is effective to maintain yearly differences of the natural room temperature smaller. The mean room temperature in the year becomes higher by transmitted solar radiation. The performance of heat storage and dissipation on the floor slab becomes greatly different whether there is transmitted solar radiation or not. Regarding weather conditions, the area of smaller number of heating days requires lower heating load, however resulting in larger cooling load. The soil of larger heat capacity brings about smaller yearly difference of room temperature. Where there is transmitted solar radiation, the mean room temperature in each year becomes lower with the soil of larger coefficient of thermal conduction. (5 refs, 15 figs, 2 tabs)

11302 (JSES—602, pp 157-160) **Experimental study on RKK solar house (Part 4). Study on passive cooling.** Ishihara, Osamu. (Kumamoto Univ., Kumamoto, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The effects of passive cooling of the solar house are experimentally compared between the pergola as a sun shade, ceiling ventilation port as a heat dissipating means by using chimney effect, ventilation port under the floor and nighttime ventilation and cold storage as night cooling effect. Regarding the effect of the pergola, a difference of about 3 times results in inflow heat quantity whether the marsh-reed screen is located or not on the pergola. In respect to the chimney effect, temperature differences are compared between where all openings closed and only ceiling and floor openings are opened. Room temperature at night becomes higher with totally closed openings, resulting in larger temperature difference between the upper and lower parts. With a closed type housing having large heat capacity, increase of room temperature in the daytime can be suppressed by the night ventilation and the effect of cold storage, although the humidity becomes slightly higher. (4 refs, 7 figs)

11303 (JSES—602, pp 165-168) **Measurement for the thermal environment of earth-covered buildings.** Kimura, Ken'ichi; Sugiura, Shoji; Nagasawa, Kazuyoshi; Oba, Koichi; Nakaya, Masato. (Waseda Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Large heat capacities of the captioned buildings bring about the effects of heat insulation and evaporation cooling by means of moisture contained in the roofing soil. Measured and simulated results for the above are reported. The covering earth provides large heat capacity of the soil, effective heat insulation and complete protection of overheating in the ceiling due to sunshine. In addition, the temperature at ceiling surface is maintained constant, which can preserve substantially at a stationary, comfortable temperature in the living room even after the ambient temperature may drop at night. The distribution of temperatures on the soil and surroundings can be correctly calculated in considering the surface water saturation ratio. Data used for the calculation was measured in Gunma Prefecture continuously on August 7-11, 1986. (6 refs, 15 figs, 3 tabs)

11304 (JSES—602, pp 133-136) **Modification of existing housing to solar house architecture and evaluation.** Nakajima, Yasutaka; Konishi, Shoji; Ito, Yukio. (Kogakuin Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Problems for modifying existing housing to solar architecture are picked up and arranged, including position and method for installing the heat collector by using the existing roof and relationship between underground heat storage tank and sunroom. A part of predicted heat balance and the results of a preliminary measurement is reported. With the heat collector installed on the east and west roofs, the heat efficiency decreases to about 70% in May-September in Tokyo, compared with the installation only in the south roof. However, the factor of dependence on solar energy is 100% in this season. Therefore, there is no difference for effectively using solar heat. The factor of dependence on solar heat, in terms of annual heat balance including heating, is about 30% in January to February. The factor in April-November, only for hot water supply, is 100%. The annual average is 77%. These values include heat recovered from the heat pump from the soil, by long-term heat storage. Items reported in the paper include the improvement of thermal environment in the south room by the sunroom, results of a preliminary test of heat media through storing and discharging the heat. (2 refs, 10 figs, 1 tab, 1 photo)

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 11273, 11274, 11283, 11284, 11285, 11290

11305 (BMFT-FB-T—86-216) **Fluorescent dyes for luminescent solar concentrators and for agricultural use. Final report.** Stange, A.; Wagenblast, G.; Seybold, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750990/JAW.

The physico-chemical investigation of the photo degradation of fluorescent dyes in PMMA led not only to important conclusions but enabled us to improve the long time stability of the system. We completed the available fluorescent dyes by new products with greenish yellow and with red colour. These new dyes have high quantum yields of fluorescence and excellent long time stability in PMMA. The red dyes can be used in agricultural applications. With 6 refs., 5 tabs., 25 figs.

11306 (CONF-870903—2) **Steady-state analysis of the rising solar pond.** Hull, J.R.; Nielsen, C.E. (Argonne National Lab., IL (USA); Ohio State Univ., Columbus (USA). Dept. of Physics). 1987. Contract W-31109-ENG-38. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002854/JAW.

From International Solar Energy Society international congress on solar energy; Hamburg, F.R. Germany (13 Sep 1987).

The rising solar pond is a configuration in which high salinity brine is injected into the pond at the bottom of the gradient zone to replenish the salt diffusing upward and to alter the salinity pro-

file to help minimize surface erosion. Steady-state salinity profiles are calculated as a function of injection and pond parameters, assuming a temperature dependent solutal diffusivity. Resulting salinity profiles are compared with the expected temperature profiles to determine stability within the gradient zone. Secondary injection near the top of the gradient is shown to improve stability, and suggestions are given for practical implementation of the rising pond concept.

11307 (CONF-8706187—, pp 198-205) **New directions in nonimaging optics.** Winston, R.; Ning, X.; O'Gallagher, J.J.; Welford, W.T. (Univ. of Chicago, IL). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Current new directions in nonimaging optics are outlined. In ray optics, new three-dimensional solutions have been found which permit a transformation of the angular divergence of a beam of light without loss. A new approach to analyzing reversed optical systems is described. Such solutions and methods may be significant in fiber optic applications. In wave optics the radiance (or specific intensity) has been calculated for uniform lambertian sources. New effects are predicted which may be significant in diffraction limited measurements.

11308 (JSES—602, pp 45-48) **Reflection concentrator with rear focus.** Sakurai, Takemaro. (Tohoku Univ., Sendai, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

The reflection concentrator with a rotary parabolic mirror is now widely used as the solar concentrator. Since the focus is in front of the concentrator, it is sometimes inconvenient to operate. An optical system of reflection concentrator with the focus in the rear is explored to study the possibility as the solar concentrator. The result indicates that the concentration ratio as larrge as approximately 14,500 can be obtained in the Cassegrain optical system with focus apart from the distance of onetenth of the focal distance, f, in the rear of the vertex of rotary paraboloid, while that as large as 23,000 or more can be obtained in the optical systems of co-focal multiple rotary paraboloid and that composed of a troidal surface and a plain. The temperature not less than 2700'C can be expected to be attained in a solar furnace using these concepts. It is considered that such concentrators have sufficient capability. (5 figs)

11309 (JSES—602, pp 49-52) **Conceptual design of Fresnel lens and segment mirror type concentrators with allowable angle of incidence.** Suzuki, Akio; Nakano, Yukihiro. (Research Inst. of Solar Energy, Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

The compound parabolic concentrator (CPC) of the stationary concentrator or the concentrator system with an angle of incidence for utilizing solar energy have been mainly improved and studied since these concentrators were worked out. The design of the concentrator system with an angle of incidence is investigated viewing from the different angle to apply the characteristic concept to the Fresnel lens and segment mirror type concentrators. The basic concept and examples of design of both concentrators are evaluated comparing with CPC. The concept of the optical system with an angle of incidence based on the single optical system gives a methodology to a lowmagnification concentrator system and it is sometimes significant. (8 refs, 6 figs)

11310 (JSES—602, pp 53-56) **Development of Fresnel's lens concentrating collection (Part 3).** Hiramatsu, Yasushi; Kotake, Hidenori; Sugiyama, Noriyasu; Sakai, Kazuhiro. (Kokujo Kanagata K.K., Aichi, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

A Fresnel's lens concentrating collector was manufactured considering mainly the reduction of manufacturing cost. The equipment is characterized by the standardized light-weight frame, collapsible structure provided with casters, usable anytime and anyplace, manual operation of sun tracking and thermal storage separated from the collector. The collector is provided with vacuum heat-collecting tube. The heat-collecting tube of linear concentrator type collector thus manufacture was filled with water. The accumulated heat was 346.5 W/sec in ten minutes after the beginning of experiment on a certain day in late September. A simplified concentrating collector was also manufactured based on the same concept. The collector is characterized by shorter heating time. Meanwhile, a collector provided with Fresnel's prism interchangeable from straight lighting type to oblique lighting type was also manufactured. (2 refs, 2 figs, 7 photos)

11311 (JSES—602, pp 57-60) **Fresnel's lens concentrating collector. Investigation of angle Fresnel's lens.** Kamoshida, Hayaji; Ishiki, Shoji. (Shibaura Inst. of Tech., Tokyo, Japan; Nihon Univ., College of Engineering, Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

The optimum design specifications of angle Fresnel's lens were calculated from the optical viewpoint using dimensionless characteristic parameters of lens to elucidate the characteristics of the light coming obliquely into the Fresnel's lens collector. The data published or used in the system already designed were used as the dimensionless characteristic parameters in this analysis to calculate the permeability of lens. The concentration of transmitted light was identified by the tracking method of obliquely incident light using the parameters under the optimum condition among the characteristic curves obtained. The average concentration ratio of energy density was calculated for the optimum condition excellent in optical concentration characteristic. The optimum design parameters were chosen from these results. The analysis was made from the data at the time when the sun came to the most extreme position in a year to obtain the definite optimum specification. (5 figs)

11312 (JSES—602, pp 61-64) **Basic investigation of concentrator using fluorescent substance.** Hayashibara, Mitsuo. (Hitachi, Ltd., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

A concentrator was manufactured on an experimental basis to improve the performance of the concentrator using fluorescent substance and the analysis based on the test result of optical characteristics of the materials composing the concentrator was made. The concentrator is composed of fluorescent substance sandwiched between two acrylic sheets. Organic fluorescent solution prepared by dissolving eosin to alcohol and capsulating with transparent encapsulant was used as the fluorescent substance. The concentration ratio based on the characteristic tests of the fluorescent substance and material of acrylic sheet composing the concentrator and the numerical calculation model was calculated. The results show that the difference between the experimental and calculated values is 10%. The result of calculation based on the numerical model indicates that the energy efficiency is decreased through the concentration ratio is increased in a thin concentrator, because the fluorescence is decreased by the absorption during passing more frequently through the fluorescent layer. (1 ref, 10 figs)

11313 (JSES—602, pp 69-72) **Indication of performance in test method of solar collection (Part 2). In case of evacuated tubular collector.** Saito, Heizo. (Science Univ. of Tokyo, Faculty of Science and Tech., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th symposium of Japan Solar Energy Society.

The solar collector is regarded as a kind of heat exchanger. This paper presents the application of the radiation air temperature of collector (SAT) as the temperature on the primary side and heat transmission coefficient to water (k) in collector to the indication of performance characteristics of collector based on the experiment of

evacuated tubular collector. Located close by the practical collector, the inside temperature (SAT) of the test collector in which no water is passed through the glass tube was measured. The characteristics of collector was determined from the relationship of SAT with the atmospheric temperature and flux of solar radiation. K was also determined from the relationship of SAT with the flow rate of water in collector and inlet and outlet temperatures. The system designing and calculation of efficiency can be conducted using these performance characteristics of collector and temperature available to the object. (3 refs, 8 figs, 1 photo)

11314 (JSES—602, pp 73-76) **Economics of hybrid collector system.** Fujiwara, Masazumi; Tani, Tatsuo. (Electrotechnical Lab., Ibaraki, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The economic validity of the hybrid collector system incorporated with a plate type collector and an east-west axis orbital, parabolic trough concentrating collector was evaluated using exergy. In collecting the heat at a constant load temperature, the hybrid system is most effectively operated at a temperature between the optimum temperatures of both collectors separately operated. The effect is increased as the cost of parabolic trough type becomes higher than that of the plate type. The energy cost is possible to be reduced by 50% at the largest. In the hybrid system operated at the optimum constant temperature depending upon the composition ratio of both collectors, the energy cost can be reduced only by 10% or less because the collector temperature can be freely set. In the hybrid collector requiring backup heat source, the efficiency of the hybrid collector system is considerably low. (3 refs, 6 figs)

11315 (JSES—602, pp 77-80) **Evaluation apparatus of amount of collected heat Part (1) .** Sakuta, Hirokazu; Sawada, Shinji; Tani, Tatsuo; Tanaka, Tadayoshi; Tsuda, Izumi; Ikeda, Nagayasu. (Electrotechnical Lab., Ibaraki, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The measuring methods of the amount of heat in the circulating system of heating medium generally includes the flowmetric and heat-amount-ratio methods. An evaluation apparatus of collected heat up to 300°C and 100 kW was designed and fabricated on an experimental basis based on the heat-amount-ratio method. The method can determine the amount of heat independent of the physical properties of heating medium and the ratio of temperature differences as the ratio requiring no temperature conversion by the same lot of sensor within 1.5% of accuracy and 0.1 kW of resolving power. The measurement is a universal method because the collected heat can be evaluated without variation with time under high long-term reliability in the same accuracy even at different places and using different heating media. It is easy to evaluate the thermal performance of various apparatuses of heat system. (1 ref, 9 figs, 2 tabs)

11316 (JSES—602, pp 81-84) **Segment mirror collector (Part 2).** Sawada, Shinji; Sakuta, Hirokazu; Tani, Tatsuo. (Electrotechnical Lab., Ibaraki, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

In order to improve the performance and reduce the cost of collector subsystem in the solar-heat utilization system, the reduction of manufacturing cost of the field type segment mirror collector, decrease of the weight of equipment, simplification of construction method and sharp reduction of installation cost by shortening the construction period were tried. Among the heat-collecting characteristics, the optical efficiency was approximately 10% lowered and the heat loss from the heat-collecting part was 7 to 8% increased up to approximately 100 W/m/200°C due to the decrease of tracking property caused by the difference among the individual mirror units. The quick deterioration of performance of the secondary lightconcentrating mirror is a problem. The cost reduction and simplification of construction method suffice the expectation as much as 70% though the reliability and performance are lowered a little. It seems that the construction method offers no problem and the operating procedure is appropriate. (1 ref, 8 figs, 4 tabs)

11317 (PB—88-853817/XAB) **Solar optical materials. January 1978-November 1987 (citations from the Inspec: Information Services for the Physics and Engineering Communities data base). Report for January 1978-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 88p. NTISPC N01/MF N01.

Supersedes PB—85-864700.

This bibliography contains citations concerning optical materials for solar energy conversion. Coating techniques and materials are discussed. Design and applications of solar-absorber converters, collectors, and concentrators are considered. Deposition and evaporation techniques, materials analysis, and performance evaluations of solar devices are included. (This updated bibliography contains 158 citations, 18 of which are new entries to the previous edition.)

11318 **Solar test collector for evaluation of both selective and non-selective absorbers.** Lampert, C.M. (Lawrence Berkeley Lab., CA, USA). *International Journal of Energy Research;* **11**: No. 3, 405-421(Jul-Sep 1987).

A solar test collector has been designed for the testing of thermally absorbing coatings under controlled conditions. The design consists of a collector fed by a controlled temperature fluid within the range of 25-90/sup 0/C (77-194/sup 0/F). Detailed design and operation data are presented and three black chrome and one non-selective absorber are analysed in detail by test collector measurements. Results show that efficiencies as high as 77 and 75 per cent ($\Delta T = 0$) are obtained for 1.0 μm black chrome on copper and nickel plated steel, respectively. The lowest loss coefficients are about 3.8 W/m/sup 20/C for all black chrome/metal surfaces, with the highest being 8.4 W/m/sup 20/C for the black paint/metal sample. Also, a collector model is presented for comparison.

1420 Heat Storage

REFER ALSO TO CITATION(S) 11280, 11291, 11297, 11299, 11300, 11301, 11302, 11303, 11304, 11310

11319 (DOE/CE/30755—T1) **Advanced phase-change materials for passive solar storage applications: Final report.** Salyer, I.O.; Sircar, A.K.; Chartoff, R.P.; Miller, D.E. (Dayton Univ., OH (USA). Research Inst.). 14 Mar 1986. Contract AC03-82CE30755. 339p. NTIS, PC A15. Order Number DE87009184/JAW.

Our current and most promising series of candidate phase-change materials (PCM) is the crystalline alkyl hydrocarbons. Ultra-pure C-16 to C-24 alkyl hydrocarbons that melt and freeze sharply in the temperature range desired for solar-passive applications are available from Humphrey Chemical at a premium price. These alkyl hydrocarbons have heats of fusion (ΔHf) of 55 to 60 cal/gm, are self-nucleating, and exhibit little or no supercooling. However, paraffin waxes are commercially available at much lower cost from several petroleum refining companies (Witco, Shell, Exxon, Union Oil, Phillips Petroleum) that have melting points ranging from 15 to 80°C, and are available at a quoted price of $0.28/lb ($0.15/lb for some grades) in tank-car quantities. We are working with Witco to further refine the commercial material in order to develop a wax that will meet our needs at an economical price. One possibly important facet of the use of the alkyl hydrocarbon PCM in cement and plaster is that these structural materials can be waterproofed simultaneously. As is well known, containment costs and attendant problems have been the bane of many of the PCM systems developed in the past. During the past year, we have preliminarily defined economic and effective methods of packaging the candidate PCMs in common construction materials. Importantly, the containment methods appear to also provide a means of adequate heat transfer; and the processes are of the type that could be rapidly implemented by commercial manufacturers of building materials. 99 figs., 81 tabs.

11320 (JSES—602, pp 89-92) **Study on effective use of underground thermal storage system by physical properties of soil (Part 1). Plan of underground thermal storage system and estimation of basic performance.** Nakajima, Yasutaka; Ohashi, Kazumasa; Kasuya, Koji; Mochizuki, Shintaro. (Kogakuin Univ., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The soil of the site where the solar system and heat storage tank would be installed was examined to estimate the basic features of the soil which was a component of the thermal storage materials in the underground solar thermal storage system installed in the Hachioji campus of Kogakuin University. The basic features were calculated using the variables including soil characteristics and initial soiltemperature in the pipe model. The result indicates that the heat storage and recovered heat increase in the order of loamy soil, sandy soil and the system soil. The heat storage is increased as the water content is increased in the order of 15%, 25% and 35%. The heat recovery rate in the system soil (water content: 25%) is approximately 50%. The heat recovery rate is increased with increasing of the water content. Although the water content of the system soil is low, the thermal storage performance is expected to be enhanced by water sprinkling. The heat capacity of the system soil is large because the density is high. It is possible to change the heat storage capacity and recovery rate by adjusting the water content of soil. (4 refs, 13 figs, 4 tabs, 1 photo)

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

11321 (NEDOJ—501, pp 628-657) **Comprehensive survey of nationalwide geothermal resources.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This study program contains such items as follows: Study by a radar image method. Curie point method. Gravity method. National evaluation of prospective geothermal areas. Method of study in 1984 shifted more to the earth-surface survey and to the comprehensive analysis from the remote sensing in the previous years. Four target areas were selected. Three out of four are a volcanic hot water flowing area and the rest is a hot prospective area (Minami-Aizu area). The three areas are Niseko, Hokkaido Type 1), Kokubu (Type 2), and Hakkoda (Type 3). From the viewpoint of hot flow distribution at 50 m depth, Niseko is rather of low temperature flow (13,397 kcal/sec), whereas Kokubu counts 29,776 kcal/sec. Hot springs in the Hakkoda area are mostly of SO_4 type. Hot springs in the central part is acidic and those outside the Hakkoda caldera are alkaline. Four documents were prepared on the basis of the analyzed data on the survey of national geothermal resources. Integrated radar pictures of Japan. Geothermal radar pictures of specific areas of Japan. Landsat pictures of Japan. Equigravitational field diagrams. (18 figs)

11322 (NEDOJ—501, pp 692-694) **Survey for the promotion of geothermal resources development.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

NEDO has been investigating promising areas for terrestrial heat for early development. In the first year, investiagtion on terrestrial chemistry, amount of hot streams, and structural boring, etc. are carried out. In addition, study on the surface of the earth and observation study on seismic micro-tremors are carried out as a preliminary environmental study. In the second year, based on the result of the first year's investigation, physical inquiry and boring investigation for close structure are carried out. In the third year, based on the results of the investigations in the first and second years, environmental boring and accompanying environmental investigation, and the overall evaluation are carried out. In 1984, three areas investigated in 1983 and four areas investigated in the first year were investigated. As the result, in Shimokita area, North of Azuma area, and the area around the Lake Ikeda, a high temperature zone of over 200°C was found in the area from Satogadaira to the basin of the River Aka and Shimofuro hot spring. In Tomibane, Yuta, West Unzen, and South Kayabe areas, a high temperature zone of over 300°C was found in the area with Yunosawa area as the center. (1 fig)

11323 (NEDOJ—501, pp 695-699) **Survey for the promotion of geothermal resources development. Evaluation method of geothermal reservoirs.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

NEDO has been developing technological methods to properly evaluate geothermal reservoirs, and estimate producing capacities, optimum scale of power generation, etc. as the project for 1984 through 1987. Development of simulators, collecting data in two model fields, analysis of the collected data by development simulators, etc. will be carried on. In 1984, the first year of the development, simulators for three dimension hot water reservoirs and 2 phase streams in pits were improved and expanded. For the former system, NEDO's simulators were applied to a variety of applications, and found to be very effective, and the speeds of their calculations were improved. The NEDO's simulators were also used for the latter, and expanded to handle combined streams in reservoirs. Kirishima area was selected as one of the model fields, and existing data were put in order for analysis by the developed simulators. (5 figs)

11324 (NEDOJ—501, pp 700-704) **Survey of large scale deep-seated geothermal energy power stations relative to preservation of the environment.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the 1984 annual report of the NEDO-contracted survey. (1) Drilling of 3,000m deep test bores — Two bores, DY-5 and 6 were drilled in the Jizobaru region which was proved to be promissing by the ground survey and else in 1983. The DY-5 bore, 3,023m deep vertically was dug by angled drilling and the DY-6, 3,003m deep drilled vertically. Strata searches by means of electricity, density and soundwave, temperature recovery measurement and preliminary survey of steam outlet were executed for these bores. (2) Planning and design of a total system — A conceptual model was made by the MT-method for the area around Mt. Izumi and Mt. Kuroiwa in the Jizobaru region. Basing upon the model above, reservoir analysis by the three dimentional simulation was performed and a model of reservoirs in the natural conditions was prepared. (3) Environmental surveillance — Regarding the survey on the environmental effects, meteorological and hot spring data were collected including the observation of changes of subterranean water. (1 tab, 1 fig)

1502 Geology And Hydrology Of Geothermal Systems

11325 (ETSU-G—133-P3) **Diagenic influences on the aquifer properties of the Permo-Triassic sandstones in the East Yorkshire and Lincolnshire Basin. Investigation of the geothermal potential of the UK.** Milodowski, A.E.; Strong, G.E.; Wilson, K.S.; Holloway, S.; Bath, A.H. (British Geological Survey, Keyworth. Geothermal Resources Programme; UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). 1987. 49p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The Sherwood Sandstone and the Basal Permian Sands contain hot brines in the eastern deeper parts of the East Yorkshire and Lincolnshire Basin. In this eastern area, the Sherwood Sandstone is up to 500 m thick and has an average permeability of 250 mD. In the Cleethorpes Well, the upper part of the formation has been cemented by anhydrite and this is probably a widespread feature in the deeper parts of the basin. Fibrous illite forms bridging meshes across the pore throats reducing the permeability. The transmissivity of the Sherwood Sandstone in the Cleethorpes Well is believed to be about 60 D.m, although this could be a conservative value.

The Basal Permian Sands are relatively thin. In the the Cleethorpes Well they are represented by fluviatile sandstones and conglomerates. The sandstones in the Cleethorpes Well are only weakly cemented, contrasting with the situation in the conglomerates. Porosity in the sandstones has been reduced by compaction and precipitation of anhydrite, quartz, ankerite and illite. The transmissivity of the Basal Permian Sands does not exceed 2 D.m in the Cleethorpes Well but in east Lincolnshire the mean value is likely to be higher than this as aeolian sands, rather than fluviatile deposits, are believed to represent the formation.

1503 Geothermal Exploration And Exploration Technology

11326 (NEDOJ—501, pp 658-691) Verification surveys of geothermal exploration technology. Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

In order to accelerate the development of deep geothermal resources by compiling the accumulated geothermal sensing technology, two model areas were selected, one being Sengan area (Akita and Iwate prefectures) and another being KuriKoma area (Miyagi Prefecture), to investigate the existance of the geothermal resources from the surface of the earth and to check the estimated result by means of a well survey. (Period, 1980 - 1986) In Sengan area, Surface investigation reflection method (medium blasting), Electromagnetic by method (MT method) and Electrical sensing was done. And well survey by thermal flow study (200 m, 400 - 800 m) and structural boring (1,500 m, 3,000 m) was also done. In Kurikoma area, surface investigation by hot image study, electromagnetic method (MT method) and electrical sensing, was done. And well survey by structural boring (1,500 m, 3,000 m) was also done. (21 figs, 1 tab)

11327 (PB—88-107040/XAB) Geothermal heat flux at the cost B-2 and B-3 wells, US Atlantic continental margin. Technical report. Vedova, B.D.; Von Herzen, R.P. (Woods Hole Oceanographic Institution, MA (USA)). Jul 1987. 84p. (WHOI—87-28). NTIS, PC A05/MF A01.

The heat flux from the earth's interior is estimated at two nearby locations on the U.S. Atlantic continental margin off New Jersey from well logs and measurements on drill cuttings samples. Vertical temperature gradients resulting from the heat flux are calculated from equilibrium temperatures deduced from repeated bottom hole temperatures measured during drilling of the holes to sub-bottom depths over 4 km. Thermal conductivity is determined from needle-probe measurements on 128 ground samples, adjusted for the in-situ lithologies, temperatures, and porosities deduced from well logs and for lithologic anisotropy estimated from the literature.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 11324

11328 (ETSU-G—125-Pl) Ecological monitoring of the CSM geothermal energy project research site: report July 1984-June 1986 to the Geothermal Energy Project. (UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). 1987. 67p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A report is given of the ecological monitoring results performed by the Cornwall Trust for Nature Conservation from July 1984 to June 1986 to assess whether there were any adverse changes due to the Geothermal Energy Project. Results are presented for lichens, flowering plants, spiders, freshwater invertebrates, birds and small mammals. The report concludes that there is no evidence of any deleterious effect of the Geothermal Energy Project on the environment.

11329 (LBL—23949) Reinjection into geothermal reservoirs. Bodvarsson, G.S.; Stefansson, V. (Lawrence Berkeley Lab., CA (USA); Braedraborgarstigur, Reykjavik (Iceland)). Aug 1987. Contract AC03-76SF00098. 21p. (CONF-8707127—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003196/JAW.

From NATO advanced study institute of geothermal reservoir engineering; Antalya, Turkey (1 Jul 1987).

Reinjection of geothermal wastewater is practiced as a means of disposal and for reservoir pressure support. Various aspects of reinjection are discussed, both in terms of theoretical studies as well as specific field examples. The discussion focuses on the major effects of reinjection, including pressure maintenance and chemical and thermal effects. (ACR)

11330 (NEDOJ—501, pp 723-735) Development of geothermal hot water generation plant. Study on the reinjection of hot water. Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984. In order to clarify the damping mechanism when low temperature water was utilized for the binary power generation, a couple of tests were carried out; a water passage test in a test unit simulated for the reinjection layer, and a reinjection test in a practical drilled well for reinjection. (1) Simulated reinjection test. Two series of test equipment were newly installed at the Hacchogawara Power Plant, where the content of silica was extremely high, for a water passage test. Reinjection of low temperature hot water below 80 °C was found to accelerate the damping of the reinjection well and to add more scale to such an equipment as a heat exchanger on the ground surface. (2) Verification test on reinjection. Tested temperature was 50 °C and 60 °C for No.1 reinjection well, and 80 °C for No.2 well. A tendency of damping was found in the reinjection capacity from the changes in amount and index of reinjection. Adhesion of scale at the peripheral portion of perforated pipes was confirmed. (2 figs)

11331 (NEDOJ—501, pp 743-761) Study on reinjection of hot water. Investigation on mechanism of hot water reinjection to underground. Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Investigation on the behavior and effect to the ground of injected hot water and development of evaluation method for areas to be developed for geothermal resource were carried out to find out ways of trouble-free reinjection of large amount of hot water. In 1984, investigation for reinjected hot water using tracers, study by simulation, observation of seismic micro-tremors, precision geodetic survey, and development of evaluation methods for areas to be developed for geothermal resource were carried out. Production and reinjection of geothermal fluid has no effect on water levels and temperatures inside the observation well. There are three types of flow for reinjected hot water. Production of steam and hot water has no effect on outbreaks of seismic tremors. Production and reinjection of hot water have no effect on the ground. The amount of steam production is one of the elements to have much effect on the behavior of geothermal reservoirs in developed areas. Temperature and presure of fluids have complex effect on the production ability of steam. It is important to establish the proper amount of steam production for the enhancement of resource value.

11332 (NEDOJ—501, pp 762-767) Development of hydrogen sulfide removal technology for geothermal power generation. Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the report of the results in 1984 of the pilot plant at Matsukawa Geothermal Power Station. Concerning the condensed water treatment by the diffusion method, the H_2S continuous measuring instrument for condensed water was adjusted and improved, and special chemical compounds were added to samples, thus problematical points were solved. Furthermore in order to attain the removal rate of more than 90%, it was recognized that the diffusing condition of the liquid at the tower head is needed to be improved. Concerning the continuous run of the plant, such results were obtained as the achievement of the removal rates of 90-99% and the

realization of the stable operation. However at the same time, such unexpected phenomena occurred as progressing scaling of filler material and inversion of PH value at the entry and exit points of the tower. Through analysis of the data and examination, many information were obtained about flactuation limits of the removal rate, temperature dependability of H_2S density of condensed water and changes of scaling and PH etc.. Furthermore from performance comparison of two kinds of filler materials, inferences were drawn about the efficiency of the diffusing tower. With regard to the exhaust gas treatment by the wet oxidation method, irrespective of clogging of exhaust pipes and diffusing plates with scales and adhesion of scales on blower-rotors, the removal rates of 99%, 90% and 92-99% were obtained for the treatments of exhaust gas from the condenser, exhaust gas through the diffusion method and mixed exhaust gas respectively.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 11337

11333 (NEDOJ—501, pp 705-712) **Development of geothermal hot water power generation plant. Research on elemental technology of binary cycle power plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on a research project on the optimum cycle and highly efficient heat exchanger for a binary cycle power plant. (1) Research was made on the heat cycle characteristics, heat stability, and safety of a heat medium which matched with the geothermal water. The result is that, at temperature higher than 70°C of exhaust water, a medium mixture (R_{114}/R_{113}) gives excellent characteristics at the temperature of the geothermal water below 140°C, and R_{114} gives high sending end output at 140 - 180°C. It was also found that pentafluoro-propanol gave excellent characteristics at the water temperature above 200°C. (2) Comparative study on the respective power generation system was made according to a heatbalance calculation program of the binary power generation. This study revealed that a joint installment with a single flash steam power generation might be superior in the output and economy. (3) In a test of highly efficient heat exchanger, R_{114} used for a condenser well coincided with the conventional equation both theoretical and experimental. It was found that nuclear boiling prevailed in the evaporator.

11334 (NEDOJ—501, pp 713-716) **Development of geothermal hot water power generation plant. Design of 10 MW binary cycle power generation plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984. Analysis of 9 items was made with emphasis on the economical aspect of the power plant. Primary evaluation of development potential of medium high temperature hot water which is a resource for the DHP-applied binary power generation system was carried out giving a potential figure of more than one million KW. An evaluation method of a binary cycle power generation system was established and was utilized for evaluating the economy of the medium and the cycle. Furon 114 was found optimum as a medium, and a binary power generating system exclusive for hot water was found superior. It is estimated that either the combination of binary cycle power generation and steam power generation or single use of a binary cycle utilizing a down hole pump will be advantageous. A plan was made for the development of 10,000 KW class verification plant. Study was made concerning the plant site and environmental adaptability, comparison with the foreign technology, and the estimation for the cost of development and construction of the verification plant.

11335 (SAND—87-0564C) **Modelling of a magma energy geothermal power plant.** Boehm, R.F.; Berg, D.L.; Jr.; Ortega, A. (Utah Univ., Salt Lake City (USA). Dept. of Mechanical and Industrial Engineering; Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 8p. (CONF-871234—5). NTIS, PC A02. Order Number DE88003793/JAW.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

We are currently investigating the engineering feasibility of drilling into an active magma body at a depth of roughly 5 km from the earth's surface, establishing a downhole heat exchange region, and extracting thermal energy from the magma body by circulating fluid through this heat exchange region. In the present paper, we evaluate the overall thermodynamic performance of various conceptual magma energy systems in which energy is added as heat to the fluid within the magma region and is converted to useful work in a power conversion cycle at the surface. Unusually high return temperatures and pressures may be available at the wellhead of such a circulating well. Cycles investigated here are an open Rankine power system in which steam from the magma well is circulated directly through a power conversion cycle and a closed Rankine cycle where the heated fluid from downhole is circulated through an aboveground heat exchanger to heat the cycle fluid. The downhole heat exchange region is established during the drilling process. As drilling proceeds into the magma, a solidified layer forms about the drilling tube due to heat exchange to the fluid. This solidified layer thermally fractures because of large temperature gradients between the cooled inner region and the heated outer region, thereby opening secondary flow paths. Two models of the downhole behavior have been used. In the simplest approach, denoted as the "infinite area model," the water entering the pipe to return to the surface is assumed to be always at the temperature of the magma, independent of mass flow rate and other parameters. The other model is more detatiled and the fractured heat exchange region is modelled as a cylindrical porous layer through which fluid flows vertically. The net power and the performance aspects for the systems are investigated in terms of various parameters, including the characteristics of the downhole heat transfer.

1509 Geothermal Engineering

11336 (DOE/CE/15295—T3) **Fabrication, assembly, bench and drilling tests of two prototype downhole pneumatic turbine motors: Final technical report.** Bookwalter, R.; Duettra, P.D.; Johnson, P.; Lyons, W.C.; Miska, S. (Pneumatic Turbine Partnership, Santa Fe, NM (USA)). Apr 1987. Contract FG01-86CE15295. 219p. NTIS, PC A10. Order Number DE88004225/JAW.

The first and second prototype downhole pneumatic turbine motors have been fabricated, assembled and tested. All bench tests showed that the motor will produce horsepower and bit speeds approximating the predicted values. Specifically, the downhole pneumatic turbine motor produced approximately 50 horsepower at 100 rpm, while being supplied with about 3600 SCFM of compressed air. The first prototype was used in a drilling test from a depth of 389 feet to a depth of 789 feet in the Kirtland formation. This first prototype motor drilled at a rate exceeding 180 ft/hr, utilizing only 3000 SCFM of compressed air. High temperature tests (at approximately 460°F) were carried out on the thrust assembly and the gearboxes for the two prototypes. These components operated successfully at these temperatures. Although the bench and drilling tests were successful, the tests revealed design changes that should be made before drilling tests are carried out in geothermal boreholes at the Geysers area, near Santa Rosa, California.

11337 (NEDOJ—501, pp 717-722) **Development of geothermal hot water power generation plant. Development of downhole pump for binary cycle power generation plant.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984. (1) Trial making, experiment, and evaluation were carried out for 5 items of elemental technology. (a) No significant abrasion was found in the leading edge and the tail-end of the wings. Underwater bearing gave 0.03 mm abrasion. Optimal shape and superior material for a thrust bearing were determined. (b) Shaft seal unit and motor pressure unifying unit gave satisfactory results as designed. (c) Purified mineral oil and triphenyl were effective for insulation; polyphenylether and polymethylphenyl-siloxane were found suitable for the bearing. (d) Insulation material and composition of the stator coil were tested

for the resistance to heat and oil which proved satisfactory. (e) A cable of combined teflon/lead-plate/fluorine-resin was trially made for various durability test. (2) Design of a verification unit and auxiliary equipments was proceeded. (3) Concerning the application of a down hole pump for CO_2-containing hot water well, influence of CO_2 was found avoidable by placing the pump at deeper depth than the depth of gas isolation.

11338 (NEDOJ—501, pp 736-742) **Development of geothermal hot water generation plant. Study on prevention of calcium carbonate scale adhesion in geothermal reinjection wells.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Development of technology for the removal of adhered calcium carbonate scale inside geothermal wells (development of calipers) and prevention of scale adhesion (analysis of mechanisms to inhibit scale adhesion) was carried out. The relation between physical properties and chemical characteristics of spouting steam and hot water and the state of scale adhesion was studied. As the result, calipers and attachment capable of measuring the state of scale on the inside of wells in accordance with the inclination, diameter, temperature, pressure, etc. of wells were developed. A small experimental device was constructed for the reproduction of physical characteristics of wells and chemical properties of hot water and for performing continual test. As the result of the experiment made using the device, it became clear that the balance of calcium ion concentration and carbonic acid gas concentration played an important role for the production of scale. Characteristics of the actual well at Mori power plant was investigated, and the relation between scale adhesion inside the well and the well-head pressure, etc. was confirmed.

11339 (NEDOJ—501, pp 768-783) **Development of hot dry rock power generation system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the report of the achievements in 1984 about the joint research and development at Fenton Hill, USA by Japan, USA and West Germany based on the IEA Agreement. In order to exercise the long term heat extraction and circulation experiment, a high pressure water injection trial was done without success from Testbore EE-3 with intention of connecting it to the artificial reservoir which had been made by injecting high pressure water through Testbore EE-2 in 1983. Consequently branch drilling was planned from Testbore EE-3, the repaire work was made to Testbore EE-2 first and the opening work for the branch drilling at the lower point of Testbore EE-3, thus the preparation for the branch drilling was completed. In parallel with the above works, the micro-earthquake verification experiments were done twice. As the result, the importance of drilling observation bores was pointed out for the increase of the accuracy of the Cambrian earthquake observation network and Bore PC -1 (resumption) and PC-2 were drilled. Various improvements were done for measuring-instrumented machinary. and an automatic analyzer was installed in the chemical trainer. In addition, a data analyzer was introduced for the treatment and evaluation on site of signals from the earthquake observation network. As for the reservoir, theoretical study on micro-earthquake waves and the process of hydraulic fracture, simulation calculation and a study of tracers were also done with respective progresses and improvements. (8 figs, 2 tabs, 5 photos)

11340 (NEDOJ—501, pp 784-788) **Development of deep-seated geothermal hot water supply systems.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the 1984 report of the hot water extraction and reinjection tests which are under way by using the testbores. (1) Extraction and reiajection tests—With intention of improving the performance of the whole system, the tests for 80 days in total were carried out including gunpowder tests and hydraulic fracture tests etc. for Testbore NO.3. As the result, the maximum reinjection volume of Testbore NO.3 alone increased by three times up to 42 ton/h. and that of NO.1 through NO.3 altogether by 1.6 times up to 69 ton/h. Reinjection pressure during the tests of the rate of 60 ton/h decreased from 55 kg/cm2 in the last year to 44 kg/cm^2. It was recognized that changes of the reinjection volume with the lapse of time has durability. But in order to investigate the cause of the decrease, hot water chemical tests were done and some knowledge was obtained about clogging objects and salt density etc. (2) Preparation of extraction and reinjection models— A study was made about the comparison between extracted water and reinjected water, and a forecast of long term changes of the temperature of extracted hot water was also done. Concequently it was revealed that temperature decrease is currently 0.3% in avarage per annum and after 10 years will reach nearly 0. (3) Survey of the ground changes—Leveling surveys were done and the results since 1979 were consoldated. As the result, it was found that no ground sinking occurs in the vicinity of the test site. (4) Consolidated analysis—Economy comparison was made between the 20 ton/h rate and the 60 ton/h rate, and the basic information for commercialization was acquired through a feasibility study. (2 tabs)

11341 (PB—88-118666/XAB) **Circular of the Government Industrial Research Institute, Tohoku, Vol. No. 4, February 1987.** (Government Industrial Research Inst., Tohoku, Sendai (Japan)). 1987. 80p. (In Japanese). NTIS, PC E04/MF A01.

See also PB—87-146049; Portions of this document are not fully legible.

Contents include: geothermal reservoir analyses for heat extraction; mathematical modelings of geothermal reservoirs; newly developed techniques of heat extraction from geothermal reservoirs; computer uses for geothermal development; references on geothermal development from the JICST file.

11342 (SAND—86-1745) **Development of a method for predicting the performance and wear of PDC [polycrystalline diamond compact] drill bits.** Glowka, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1987. Contract AC04-76DP00789. 197p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88001450/JAW.

A method is developed for predicting cutter forces, temperatures, and wear on PDC bits as well as integrated bit performance parameters such as weight-on-bit, drilling torque, and bit imbalance. A computer code called PDCWEAR has been developed to make this method available as a tool for general bit design and analysis. The method uses single-cutter data to provide a measure of rock drillability and employs theoretical considerations to account for interaction among closely spaced cutters on the bit. Experimental data are presented to establish the effects of cutter size and wearflat area on the forces that develop during rock cutting. Waterjet assistance is shown to significantly reduce cutting forces, thereby potentially extending bit life and reducing weight-on-bit and torque requirements in hard rock. The effects of several other design and operating parameters on bit life and drilling performance are also investigated.

1520 Geothermal Data And Theory

11343 (CONF-8706187—, pp 26-36) **Semi-automated Burnett PVT apparatus: properties of a geothermal working fluid.** Linsky, D.; Sengers, J.M.H.L.; Davis, H.A. (National Bureau of Standards, Gaithersburg, MD). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A Burnett-isochoric facility has been constructed in which the equation of state of fluids and fluid mixtures can be obtained in automatic fashion along paths of constant volume. The automated working range is from 273-473 K in temperature, and up to 10 MPa in pressure. How the automation of preasure and temperature control and measurement has been achieved is described. The apparatus has been used for the determination of the thermodynamic properties of a working fluid mixture for a binary geothermal power cycle. The performance of the apparatus is evaluated by means of the data obtained. Plans for further improvement of range and accuracy are outlined.

16 TIDAL AND WAVE POWER

11344 (MP—58010) Forecasting Beaufort Sea wind waves by momentum balance method - further hindcast studies. (MacLaren Plansearch Ltd., Halifax, Nova Scotia (Canada)). Jun 1987. vp. Forecast Research Division, Atmospheric Environment Services, 4805 Dufferin Street, Downsview, Ont., Canada M3H 5T4; $N/C.

The ability to forecast waves accurately provides invaluable support for those who depend on the sea for their livelihood. The reason for developing such a model is to provide accurate information such that safe operational procedures can be adopted at sea. Operation of drill rigs and vessels depends largely on wave climate. This report discribes the development of a practical wave forecast model for the Beaufort Sea. Included are the background and theoretical basis for the model and the algorithms and numerical techniques. The Beaufort Sea domain and data availability and processing are described. Model evaluation, sensitivity analysis and suitable model paramenters are discussed. Results of extensive statistical evaluation of model performance are presented. Outlined are major conclusions and recommendations. 27 figs., 15 tabs.

1607 Tidal Power Plants

11345 (TPC—8705) Environmental impacts of large-scale tidal power development in the Bay of Fundy. Baker, G.C. (Tidal Power Corp., Halifax, Nova Scotia (Canada)). May 1987. 31p. Tidal Power Corporation (N.S.), Duke St. Tower, Ste. 1109, 5251 Duke St., Halifax, N.S., Canada B3J 1P3; $N/C.

The Tidal Review Board was established in 1972 as a joint undertaking of the governments of Canada, New Brunswick and Nova Scotia. The Board engaged a branch of Environment Canada to conduct hydrodynamic numeric modelling for the purpose of determining the changes in the tidal regime produced by a tidal power plant. Two sites in the Bay of Fundy have been identified where tidal power may be developed with net economic benefit. They would appreciably alter natural ebb and flow of the tides and would be capable of imposing significant changes on the natural environment. This paper presents a summary of probable impacts together with rough estimates of their magnitude. It concludes that only two impacts are potential project-stoppers: fish mortality and the effect of increased tides on the New England coastline.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 11191

11346 (JSF—701, pp 1-12) **Study on utilization technology of wind-heat energies.** Kobayashi, Yoshinori. (Science and Technology Agency, Tokyo, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

Wind-heat energies utilization system was developed aiming at using the heat directly converted from the wind power for space-heating of agricultural greenhouse in Phase I of the study on the utilization technology of wind-heat energies. The system is mainly composed of the wind turbine, air compressor heat generator, heat storage using hydrogen storage alloy, air-water heat exchanger, greenhouse and space-heating facilities. The demonstration test was carried out to measure the performance of each subsystem and to grow vegetables in the coldest season using the system applied. The integrated utilization efficiency using the heat storage process by the hydrogen storage alloy was 12% (heat storage in hydrogen storage alloy:7% and output of cooling water from heat generator:5%) and that using the hot-water storage process was 15% (hot-water storage:8% and output of cooling water from heat generator:7%). (2 refs, 8 figs, 5 tabs, 1 photo)

11347 (JSF—701, pp 13-22) **Demonstrative examination of combined utilization of local energies. Wind power generation in Tachikawa Town, Yamagata Prefecture and Honjo City, Akita Prefecture.** Yoshimoto, Hideyuki; Hijimoto, Mutsuo; Kano, Kimio. (National Inst. of Resouces, Tokyo, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

The utilization method of renewable energy such as natural energy and energy retained in wastes as the local energy source was studied for applying to the combined system of the renewable energies. The demonstrative examination is presented by giving the instances of the combined system utilizing wind and biomass in Tachikawa, Yamagata Prefecture and the combined system utilizing geothermal, wind and solar energies in Honjo, Akita Prefecture. In Tachikawa, dung of pig is dried and hardened into pellets. The pellets are burnt in a hotwater boiler for floor-heating of pigsties. Also the power generated by wind is supplied to the lighting and space-heating of the pigsties. In Honjo, geothermal water generated by non-volcanic deep-seated geothermal heat accompanied with the wind power in winter and solar heat in summer in the region examined is used all the year round for space-heating and domestic hot-water system in an old-age home. (2 refs, 7 figs, 5 tabs)

11348 (JSF—701) 8th Wind Energy Symposium. (Science and Technology Agency, Tokyo (Japan)). Nov 1986. 182p. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

The Proceedings from the 8th Wind Energy Symposium are presented.

1701 Availability (climatology)

11349 (JSF—701, pp 39-47) **Analysis of wind condition data.** Nagai, Hiroshi; Shinoda, Jinkichi; Ushiyama, Izumi. (Nihon Univ., College of Industrial Tech., Tokyo, Japan; Ashikaga Inst. of Tech., Tochigi, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

The possibility of pumping up to cultivated field and pumping out of the paddy field utilizing wind energy in Kujukuri area of Chiba Prefecture was analyzed. It was concluded that the wind conditions must be observed for a period not less than a half year at the point where the wind turbine will be installed, though AMeDAS's wind information is helpful as the wind condition data. According to the wind conditions in Katagai area, 187,000 tons of water per a pump driven by a propeller wind turbine in a year and 1,220 tons of water per a pump driven by a Savonius Wind turbine in a year can be pumped out. The drainage plan for the model area of 384 ha requires three propeller wind turbines and 344 Savonius wind turbines, if the wind turbine-driven pump alone are used, to pump out approximately 10% of the water corresponding to the precipitation in non-irrigation season. (6 figs, 2 tabs)

1704 Economics

REFER ALSO TO CITATION(S) 11350, 11351, 11364

1705 Environmental Aspects

11350 (DOE/BP/11191—13) Cape Blanco wind farm feasibility study: Summary, 1987. (USDOE Bonneville Power Administration, Portland, OR). Nov 1987. Contract AC79-83BP11191. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003749/JAW.

The Cape Blanco Wind Farm Feasibility Study investigated the engineering, economic, environmental and meteorological aspects of a proposed 80 MW wind energy project on a 1600-acre site southeast of Cape Blanco, Oregon. Study sponsors evaluated the potential impacts of large (2500 kW) MOD-2 and intermediate (170 kW) FloWind turbines. This volume is a summary of the study and its conclusions.

11351 **(DOE/BP/11191—14) Cape Blanco wind farm feasibility study: Final report.** (USDOE Bonneville Power Administration, Portland, OR; Portland General Electric Co., OR (USA); Pacific Power and Light Co., Portland, OR (USA); Windfarms Northwest (USA)). Nov 1987. Contract AC79-83BP11191. 209p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88003748/JAW.

The Cape Blanco Wind Farm (CBWF) Feasibility Study was undertaken as a prototype for determining the feasibility of proposals for wind energy projects at Northwest sites. It was intended to test for conditions under which wind generation of electricity could be commercially feasible, not by another abstract survey of alternative technologies, but rather through a site-specific, machine-specific analysis of one proposal. Some of the study findings would be most pertinent to the Cape Blanco site - local problems require local solutions. Other findings would be readily applicable to other sites and other machines, and study methodologies would be designed to be modified for appraisal of other proposals. This volume discusses environmental, economic, and technical issues of the Wind Farm.

11352 (NEDOJ—501, pp 799-802) **Environmental effect of large scale wind power generation system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the 1984 report concerning surveys based on the operation of a 100KW wind power generation plant in Miyakejima. The results of the actual survey revealed that no effect exists due to low frequency noise from the 100KW mill since 88 dB and 84 dB were measured at the points of 75m and 145m from the mill respectively. Assessment was done at Omaezaki which was chozen as a model. The results showed that no effective element against the natural environment exists except the possible impact of wind disturbance against fauna and flora. Against the human environment, noise, low frequency noise and radio wave disturbance were found to provide impacts. Concerning noise, no effect was observed since wind noise exceeded the environmental standard level. With regard to the range of low frequency noise effect, it was inferred from the documented records that rattling noise of house screens are to be sensed at the points of 900m and 100m from the m for low frequencies of 5 Hz and 17 Hz respectively and no effect for 27 Hz. Among radio wave disturbances, ghosts and flickering images were observed within the zone of approximately 2 km towards the direction of Hamamatsu. In Europe, 10 MW class machines exist at present time and the 100KW class has been chozen as the target technological base. Their results are expected to be useful for the future development of our countrry.

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REFER ALSO TO CITATION(S) 11211, 11904

11353 **(BMFT-FB-T—86-092) Construction and test of a windpark on the Kykladen island of Kythnos (Greece). Final report.** Knuenz, D. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 214p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88750982/JAW.

Within the German-Greek scientific and technological agreement the MAN Technologie GmbH and the Public Power Corporation of Greece (PPC) tested the energy supply of a small island by wind energy. Non-fossile and non-nuclear power supply is realised by a windpark. The plants support the existing small network of the island and thus the Diesel consumption of the power station is reduced. The innovative load management and control system specially designed for the feed-in of a high wind power proportion proved well during the 3 years of operation. Considering the state of wind power technology at the beginning of the project the availability of 75% is a satisfactory result. There are places in Greece with suitable conditions for the intensive use of wind energy similar to those of the Island of Kythnos. The experience with the windpark project of five AEROMAN 11/20 plants is useful for the development of similar appropriate technology projects. With 11 refs., 14 figs., 6 tabs.

11354 **(BMFT-FB-T—86-208) Planning and construction of a solar chimney demonstration power plant. Practice orientated design for larger units together with an extended measurement programme. Final report.** Schlaich, J.; Bergermann, R.; Friedrich, K.; Haaf, W.; Lautenschlager, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 401p. (In German). NTIS (US Sales Only), PC A18/MF A01. Order Number DE88750988/JAW.

The physical fundamentals of solar chimneys have been elaborated. The construction of a pilot plant at Manzanares, Spain, and the measurements carried out allowed a reliable judgement of the behavior of such systems in long-term operation. This report treats also constructional problems that occured during the first test phase and reveals prospects for their future solution. On the basis of the test results possible improvements of the plant control system have been elaborated. It has been shown that with this kind of system economic large-scale solar energy production has good chances. With 30 refs., 50 tabs., 181 figs.

11355 **(DOE/NASA/20320—73) Performance and power regulation characteristics of two aileron-controlled rotors and a pitchable tip-controlled rotor on the Mod-0 wind turbine.** Corrigan, R.D.; Ensworth, C.B.F. III; Miller, D.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1987. Contract AI01-76ET20320. 22p. (NASA-TM—100136). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001481/JAW.

Tests were conducted on the DOE/NASA Mod-0 horizontal-axis wind turbine to compare and evaluate the performance and the power regulation characteristics of two aileron-controlled rotors and a pitchable tip-controlled rotor. The two aileron-controlled rotor configurations used 20-percent- and 38-percent-chord ailerons, while the tip-controlled rotor had a pitchable blade tip. The ability of the control surfaces to regulate power was determined by measuring the change in power caused by an incremental change in the deflection angle of the control surface. The data shows that the change in power per degree of deflection angle for the tip-controlled rotor was four times the corresponding value for the 20-percent-chord ailerons. The root mean square power deviation about a power setpoint was highest for the 20-percent-chord aileron, and lowest for the 38-percent-chord aileron. 1 ref., 19 figs.

11356 **(ETSU-N—103) Electrical generation aspects of wind turbine operation.** (Energy Technology Support Unit, Harwell (UK)). 1987. 125p. (CONF-8705238—). NTIS (US Sales Only), PC A06 MF/A01. Order Number DE88751260/JAW.

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

Workshop proceedings presented cover advantages and disadvantages of variable versus fixed speed generator operation, rectifier inverter systems, synchronous generators with static frequency conversion, variable speed induction generators and direct coupled generators. Synchronous and induction generators are compared, and supply interface, applications of fixed and variable speed on WTG design and switched reluctance generators are reviewed.

11357 (ETSU-N—103, pp 9-21) **Generation options.** Freris, L.L. (Imperial Coll. of Science and Technology, London, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The advantages and disadvantages of variable versus fixed speed operation are presented and the claims of enhanced energy capture by the variable speed option discussed in some length. The characteristics of dc, synchronous and induction generators are then considered and a number of interfacing schemes that permit variable speed operation briefly looked at in terms of pros and cons.

11358 (ETSU-N—103, pp 23-25) **Comments on L. Freris' introductory talk, BWEA symposium, Leicester University on 12.5.87.** Mayer, R.M. (British Petroleum Co. Ltd., London). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

An additional type of rectifier inverter system is described. This is the microprocessor controlled inverter system based on pulse width modulation. Since the commutation is microprocessor-driven, it is possible for the current and voltage to be in phase. Tests carried out in Helsinki to verify the functionality of such a system for weak grids demonstrated that the system functioned effectively, harmonics were low and a high efficiency of the drive was obtained with power flowing in either direction.

11359 (ETSU-N—103, pp 27-37) **Synchronous generators with static frequency conversion.** Snazell, G.E. (General Electric Co. Ltd., Wembley, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The basic characteristics of static frequency conversion are outlined and the advantages and disadvantages explored. The experience of operating the WEG M5-1 machine in a PCU-mode is described and current and recent developments likely to affect PCU design are discussed.

11360 (ETSU-N—103, pp 39-49) **Variable speed induction generators.** Smith, G.A. (Leicester Univ., UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The operation of a slip-ring induction generator to provide a wide range of variable-speed operation for a wind turbine is described. The conventional Kramer system, well known in drives up to 2 or 3 MW, is based on established technology but provides generation only above its synchronous speed. Nevertheless, such equipment is being used on wind turbines operating up to 50% above synchronous speed. Leicester University has developed a novel form of this system which provides a machine that can generate or motor at speeds both above and below synchronous speed.

11361 (ETSU-N—103, pp 51-75) **Direct coupled generators for wind turbines.** Somerville, W.M. (NEI Parsons Ltd., Newcastle upon Tyne, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The implications of applying directly coupled generators to vertical and horizontal axis wind turbines are examined. The limitations on the options available imposed by the electrical design and mechanical constraints are discussed and their effects on the mode of coupling of the output to the network are considered. The advantages and disadvantages of the concepts are discussed briefly.

11362 (ETSU-N—103, pp 77) **Morning discussion.** Gardner, G.; Freris, L.; Chappell, M.; Scott, P. (Central Electricity Generating Board, London, UK; Imperial Coll. of Science and Technology, London, UK; NEI, Peebles, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The CEGB's study of the various benefits of variable speed WTGs during 1979 for a 2 speed stall regulated WTG with a wide characteristic is discussed and results indicating increase in energy capture depended on the site and varied from about 47% on a good hillsite to about 1.7% on a poor hill top site are considered. The possibility of having 2 generators on the same shaft which is common practice in some of the Danish machines is outlined and the advantage of better energy capture due to the better efficiency of the smaller generator operating at its near full load output rather than a large generator running a small fraction of its rating where efficiency is low is discussed. Electrical switching of PAM and twin machine combinations when going from low to high wind speed, use of 'soft start' equipment which is typically a thyrister circuit in line with the induction machine; previous use by DAF Indal of the Star/delta shift in the generating mode as well as the start mode, and the recent design of a medium sized VAWT using generators over a 2 speed range because of the requirement to match a weak local supply system are reported.

11363 (ETSU-N—103, pp 129-165) **Supply interface.** Gardner, G.E. 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The electricity supply system and the ways in which wind turbine generators are likely to be connected into the network are discussed. It is shown how the method of connection could influence the choice of generator. In this context a paramount requirement is the security of the supply and the avoidance of interference to consumers. The requirements for maintaining adequate quality of supply are discussed in relation to the different types of wind turbine generator. The potential impact on the supply of the different variable speed systems are discussed and consideration given to the constraints likely to be imposed on single machines or large groups connected into a distribution network. The benefits which might be obtained from variable speed operation are considered.

11364 (ETSU-N—103, pp 167-197) **Implications of fixed/variable speed on WTG design: cost effectiveness of variable speed operation.** Bossanyi, E.; Armstrong, J.R.C. (Taylor Woodrow Ltd., Whetstone, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The cost of energy, benefits and penalties are examined. The proportions of installed cost that can be afforded for variable/two speed conversion equipment for the MS-Z at its optimal site of 8 M/S AMWS are presented. Conclusions outlined include variable speed operation is unlikely to be cost effective at optimal sites for an equivalent fixed speed machine, but might be at lower wind speed sites, and 2-speed operation is likely to be more cost effective than variable speed.

11365 (ETSU-N—103, pp 199-201) **Some comments on switched reluctance generators.** Fulton, N.N. (SR Drives Ltd., Leeds, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

The rapid development of SR systems is discussed. Over the years, induction and synchronous machines have been designed and refined essentially for fixed-speed operation and therefore have to be adapted/modified for variable speed. In these forms they are not necessarily at their best. SR machines, by contrast, are designed from scratch as variable-speed drives and they reap corresponding benefits. One of these benefits is in efficiency. The SR drive is very efficient - systems built and carefully tested have shown high efficiency not only at one operating point but over a wide range of power and speed. The SR system is fully controlled and has no inherent stability problems like those which can afflict induction or synchronous machine systems.

11366 (ETSU-N—103, pp 79-126) **Synchronous/induction generator testing on the WEG MS2 turbine.** Warren, J.G.; Gamble, C. (Taylor Woodrow Ltd., Whetstone, UK). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751260/JAW. (CONF-8705238—).

From BWEA/DEN workshop on electrical generation aspects of wind tubine operation; Leicester, UK (12 May 1987).

An experimental test programme, funded by the Department of Energy, to examine the performance of different generators using the WEG prototype MS2 turbine at Ilfracombe is described.

Data acquired during the experiments is presented together with some analytical results in the form of spectra, probability distributions and cross plots. Preliminary results provide generator comparisons in the form of wind speed curves, power factors and transients. Given the very preliminary nature of the analysis to date, no conclusions are drawn regarding the performance of the various generator configurations.

11367 **(ETSU-WN—5058-Pt.1) Turbulence as seen by rotating vertical axis wind turbine blades.** Hassan, U. (UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). May 1987. 42p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Order Number DE88750643/JAW.

There is clear evidence that the turbulence in the wind plays an important role in the determination of the loads encountered by wind turbines. Major advances have been made in the calculation if the loads experienced by horizontal axis machines but parallel development for vertical axis turbines has been hampered by the statistical non-stationarity of the turbulence seen by the rotating blade of a VAWT. An experiment to provide such data was carried out in order to validate the findings of the theoretical models and to provide a means for the direct assessment of the importance of the non-stationary nature of the turbulence. In the experiments a hot-wire anemometer on a rotating arm in turbulent flow in a large wind tunnel was used to measure the turbulence as seen from a rotating frame of reference. The effects of tip speed ratio and the ratio of turbulence length scale to rotor radius were investigated.

11368 **(ETSU-WN—5074-Pt.1) Effect of aerofoil characteristics on wind turbine performance. A brief sensitivity analysis.** Garrad, A.D. (UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). Jan 1987. 35p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Order Number DE88750642/JAW.

The sensitivity of the energy capture of a wind turbine to the characteristics of the aerofoils used on the rotor, and the aerofoil characteristics which are most influential in this matter are discussed, concentrating on pitch controlled machines with some reference made to stall control.

11369 (JSF—701, pp 23-38) **Development of utilization technologies in Sunshine Project. Focusing on operation result of 100 KW-wind power generation.** Kuranami, Shin'ichi. (Ministry of International Trade and Industry, Tokyo, Japan; Agency of Industrial Science and Technology, Tokyo, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

An experimental apparatus of 100 KW-wind power generating system was installed at Izu Point of Miyake Island and had been operated from 1983 to 1985. The basic specifications of the rotor are as follows: diameter of 29.4 m; down wind type; fixed pitch at a velocity of the wind of 5 to 10 m/s and variable pitch at 10 to 22 m/s. The system was operated at the constant level of 100 KW. The circuit was composed so as to send the electricity generated by a synchronous generator to the consumer system through a frequency changer. The result of operation was as follows: the wind turbine has enough strength to operate even in the cut out velocity of the wind of 22 m/s; coefficient of output of wind-powered turbine and output of generator exceed the design values by 20%; the knowledge on the control characteristics such as startup, stop, control of variable pitch and yaw control characteristic was obtained; continuous operating time was 629.3 hrs; and output of generated power was 41,707 KWh. (6 figs, 5 tabs)

11370 (JSF—701, pp 48-63) **Outline of China Wind Power Plant.** Kusunoki, Kenichi. (Kyushu Electric Power Co., Ltd., Fukuoka, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

China Wind Power Plant of rated output of 300 KW was constructed in Okinoerabu Island of Kagoshima prefecture aiming at reducing the generating cost in a solitary island. The demonstration test is being made. The average velocity of the wind at the plant site is 6.4 m/s. The velocity of the wind at the point of the turbine axis 30 m above the ground is 1.2 to 1.28 times that at the point 10 m above the ground. The wind turbine is composed of three blades with the full length of 16.4 m. The blade consists of the fixed blade made of FRP and the variable blade made of corrosionresistant aluminum alloy. The generator is an induction generator. The wind turbine was preliminary set up to establish the smooth startup and stop operations and the output characteristic during the load test could be approximated to the design values. The appropriate electricity generated could be supplied to the distributing system. The actual results of the operation from 1982 to 1986 are as follows: average velocity of wind in a calendar day was 5.3 m/s, cumulative output of generated electricity was 620 x 10^3 KWh and operation time was 650 days or 6,700 hrs. (12 figs, 3 tabs, 3 photos)

11371 (JSF—701, pp 64-75) **Wind power utilization test at Omaezaki.** Seki, Kazuichi; Suzuki, Masao. (Tokai Univ., Research Inst. of Industrial Science, Kanagawa, Japan; Shizuoka Prefectural Government, Shizuoka, japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

A wind power utilization system was installed at Omaezaki in Shizuoka prefecture to supply the power to a people's inn. The actual service test has been made. The wind turbine system is composed of Tokai University type linear blades of fixed pitch vertical axis. The specifications of the blade are as follows; 3 blades, each has wind receiving area of 25 m^2, span of 5 m, diameter of 5 m, chord length of 0.18 m and six arms, each has span of 2.5m, chord length of 0.14 m. A Savonius wind turbine is incorporated in the system for the backup of startup. The generator is an outside-induced AC synchronous generator of output voltage of 24 VDC and maximum output of 2.2 KW. The control system comprises generator control, wind turbine control and start-up control sections. For the wind conditions, the relative frequency of high velocity of the wind is high all the year round. Especially, the relative frequency of high velocity of the wind exceeding 10 m/s for five months from November to March is as high as 15 to 30 m/s. The operating efficiency of generator is higher in summer because relatively weak wind blows frequently. (9 figs, 2 tabs, 1 photo)

11372 (JSF—701, pp 89-103) **Standardization of wind turbine.** Matsuyama, Teru. (Mechanical Engineering Lab., Ibaraki, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

The standards of design and standardization of performance test method of wind turbine are briefly presented. The technical standards have been proposed by Department of Energy and Source Development of Sweden, IEA, American Wind Energy Association (AWEA)and Canadian Standard Association. These technical standards are focused on both normalization of load standard and standardization of performance test method. In the normalization of load standard,the condition of design load are decided by setting the environmental conditions such as the average velocity of wind, wind shear, maximum velocity of wind, gust, fluctuation of winddirection, icing, falling, falling of thuderbolt, hail and earthquake. In the standardization of performance test, the accuracy and installation place of every instrument including the anemometer are decided and in the standardization of performance test method, the testing machines, test period and sampling frequency are decided. Bin method is proposed as WECS test method. (5 refs, 1 fig,11 tabs)

11373 (JSF—701, pp 104-119) **Development of 250 KW raising and tumbling wind power plant.** Tsushima, Ken; Shimada, Tamotsu. (Mitsubishi Heavy Industries, Ltd., Nagasaki Factory, Nagasaki, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

A few wind power plants of medium-to-large capacity of tens to hundreds KW have been developed in Japan. These plants have been developed mainly to reduce the electricity cost in soli-

tary islands. A wind power generating equipment of rated capacity of 250 KW has been developed for Koyagi wind power plant. Considering the conditions of location to be installed, a raising and tumbling monopole tower was adopted. The equipment was constructed in such a way that every component was made compact and light-weight and the propeller and nacelle parts were prefabricated. The geographical models in the vicinity of the candidate site were tested in a wind tunnel to select the plant site. A variable-pitch propeller was used to obtain high efficiency in a wide range of velocity of the wind and the automatic control system was used depending upon the condition of the wind. The operation was started in December, 1985, and the performance meets almost the expectation. (2 refs, 10 figs, 1 tab, 3 photos)

11374 (JSF—701, pp 120-126) **Trial manufacturing of double contrarotating wind power generating equipment.** Sasaki, Kazuto; Matsuzaka, Tomoyuki. (Hachinohe Inst.of Tech.,Aomori,Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

A double contrarotating wind power generating equipment was manufactured on an experimental basis to enhance the generating efficiency utilizing the effect of the speedincreasing of generator by harnessing the wind energy which has a disadvantage of large fluctuation in the velocity and direction of the wind. The equipment is characterized by providing with each set of wind turbine on the windward and leeward of the generator constructed in such a way that these wind turbines are connected to the rotor and stator, respectively, of the generator and rotate in the opposite direction to each other. The relative number of revolution of generator is so large that the high output can be obtained. The generator follows steadily the fluctuating direction by the gyro-moment effect of the front and rear wind turbines. The generator without tail can be controlled to the direction of the wind. The experimental result indicates that the double contrarotating type wind turbine generates more output than the single one and the former is more steadily and smoothly controlled to the direction of the wind. (4 refs, 4 figs, 1 tab, 1 photo)

11375 (JSF—701, pp 127-133) **Development of sailwing turbine.** Nishimoto, Sumi. (Hiroshima Inst. of Tech., Hiroshima, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

The sailwing comprises transformable airfoils the tension of which alone balances with the fluid power. For the field experiment of the gyro-mill type airfoil using the sailwing, the possibilities of structure, performance and control method are summarized. The numerical analytical method expressing the hydrodynamic characteristics of sailwing in a quadratic form has been reported. The airfoil is compared with a rigid airfoil in no-load characteristics and output efficiency curve. The number of revolution at no load to the wind velocity are so small that the operational latitude of the optimum number of revolution of wind turbine is practically narrow. These characteristics show that an induction generator is suitable for the wind turbine. Invertor control is, therefore, applicable to matching of system. (4 refs, 3 figs)

11376 (JSF—701, pp 134-152) **Wind turbine viewing from standpoint of industrial archaeology.** Kawakami, Kenjiro. (Tama Art Univ., Tokyo, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

Traditional wind turbines in Japan and abroad are reviewed from the standpoint of industrial archaeology, comparing with the related hydraulic turbines. It is imagined that the wind turbine traces its origin to the districts where only the wind load can be utilized. A prototype of powered wind turbine has been transmitted from old times in Tibet, while small hydraulic turbine of the similar type are operated in Nepal and Bhutan. Since the hydraulic turbines are reliable from the view points of topograph and precipitation in Japan, few wind turbines are used. Wind turbines have been used as the small power source on the middle and lower courses of European rivers. The initial powered wind turbine was comprised of a horizontal main shaft provided with plate sails. After that, the material of sail was changed to canvas and then the canvas was reinforced checkerwise with wood. After a while, a horizontal shaft wind turbine replaced that and then it was replaced by a tower type which was all to follow the direction of the wind. (21 refs, 17 figs, 8 photos)

11377 (JSF—701, pp 153-157) **Trend of Japanese wind turbine.** Kimura, Sozo. (Japan Wind Energy Association, Tokyo, Japan). Nov 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770028/JAW.

In 8th Wind Energy Symposium.

Japanese Wind Turbines was published from Japan Wind Energy Association (JWEA), presenting some consideration on 136 wind turbines. This paper describes the supplementary explanation and the classification viewing from different angle followed by the another classification according to the type, structure and examples of wind turbine, material of impeller and measures against gust. The definition and situation of the classification stated in the tables in that publication are explained additionally. The other types of natural energy used in relation to the wind load are presented. Some examples are given to illustrate the method by which the cut-in velocity of the wind is decreased by controlling the load based on the impeller side with fixed or changeable pitch in order to use the wind load in a wide range from low to high velocity of the wind, and the wind load is completely utilize at high velocity of the wind. (1 tab)

11378 (NEDOJ—501, pp 793-798) **Development of large scale wind power generation system (100 KW class).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is the 1984 report of the ope:ation tests of a test verifica tion machine which was linked to the electricity distribution system of Miyakejima. (1) Concerning the variable pitch and yaw control in association with velocity and direction of the wind, it was confirmed that the motion of the automatic control system was normal as planned through the test using the control coefficient which had been set by the independent operation in 1983. (2) The loads on blades and rotor axis were approximately same as the results of the independent operation test. (3) Blade characteristics and electricity generating characteristecs were both in the same trends of the theoretical values, but in average 20% above the latter. (4) Voltage at the time of the operation with the distribution system remained almost unchanged in comparison with the time of the operation without and high-pitched waves from the frequency converter were reduced. (5) A part of the trailing edge of the top section of the blade was peeled and a repair was made. This was caused by the uneven bonding strength of the bonded portion. (3 figs)

11379 (NEDOJ—501, pp 803-811) **Large scale wind power generation system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objective is to analyze the results of operation of the experimental 100 KW class aerogenerator, and evaluate the technology, cost, and energy supply of the system. In 1985, the following subjects were investigated and studied for the purpose: Based on the design and construction data of the experimental 100 KW class aerogenerator, materials, number, cost, weight, and number of processes of each part to be affected by design modification were analyzed. In addition, cost estimation for large scale wind turbine system and comparison with similar scale of overseas products were made. To acquire basic data for the elucidation of wind characteristics, capes and dam sites were selected as model cases. Wind energy application systems suitable for the wind characteristics in Japan were studied, and hybrid systems to work with existing and new energy systems were also studied for possibility.

11380 (NP—8751251) **Design, dimensioning and construction of a tower with variable geometry and eigenfrequency for an experimental wind turbine.** Roeer, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1985. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751251/JAW.

In order to meet the demands for a tiltable tower with adjustable eigenfrequencies for the experimental-windturbine of the project OPTIWA a tower concept has been developed after several solutions have been discussed. The main structure consists of a 14 m long steel tube with a high stiffness. 5 m above ground level it is positioned by three supporting struts. By means of releaseable GFPR-springs at the base of the supporting struts the stiff version can be altered to a soft tower concept. The boundary conditions and strategies for the design and construction of the main tower components are introduced in the paper. Furthermore the hydraulic equipment, tests and the tower erection is documented.

11381 **(NRC/E—NRCC/27606) A perspective on Canadian windpump technology. Technical memorandum.** Chappell, M.S. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). May 1986. 13p. (MICROLOG—87-04576). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Most Canadian windpump technical activity is concentrated in Southern Alberta. There is both a continuing and expanding domestic market for windpumps ranging from small farm-scale units for cattle watering to very large units suitable for regional irrigation applications. There is strong potential-user interest. An increasing interest is being shown by wetlands preservation agencies and other environmental/ecological groups. There is significant export potential to mid-western United States and ultimately worldwide potential for appropriate windpump technology in developing countries. The Brace Research Institute, Montreal, Quebec, is active in development of various technologies appropriate to third world applications, including windpumps. A windpump test facility has been established to aid in the development and evaluation of Canadian windpump technology.

11382 **(PB—88-109772/XAB) Optimal control of wind turbines).** Jakobsson, B. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Aug 1987. 16p. (In Swedish). (FOA-C—20670-2.7). NTIS, PC E03/MF A01.

The use of optimal control theory concerning the control of the electrical torque of a wind turbine is discussed. The work was sponsored by the National Energy Administration.

11383 **(SAND—87-1082C) Data acquisition and analysis system for the Sandia 34-meter Vertical Axis Wind Turbine.** Berg, D.; Rumsey, M.; Gallo, L.; Burwinkle, D. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Engineering Research Inst., Albuquerque (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-880132—3). NTIS, PC A02. Order Number DE88002417/JAW.

From 7. wind energy symposium; New Orleans, LA, USA (10 Jan 1988).

Sandia National Laboratories has designed and built a 34-meter Vertical Axis Wind Turbine. Acquisition, storage, reduction, display, and analysis of the extensive data from this machine are accomplished with the use of a minicomputer-based data acquisition and analysis system. This paper discusses the development of that system and describes the vendor-supplied computer-system hardware and software, analog-to-digital converter hardware, and the Sandia-developed data acquisition and analysis software that is now operational. Plans for future enhancements of the system are also discussed. 8 refs., 4 figs.

11384 **(SAND—87-1256C) VAWT [Vertical-Axis Wind Turbine] stochastic loads produced by atmospheric turbulence.** Homicz, G.F. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 11p. (CONF-880132—2). NTIS, PC A03. Order Number DE88001355/JAW.

From 7. wind energy symposium; New Orleans, LA, USA (10 Jan 1988).

Blade fatigue life is an important element in determining the economic viability of the Vertical-Axis Wind Turbine (VAWT). A principal source of blade fatigue is thought to be the stochastic (i.e., random) aerodynamic loads created by atmospheric turbulence. This paper discusses the development of a model for the simulation of these stochastic loads, given the rotor geometry, operating conditions, and assumed turbulence properties. A Double-Multiple-Streamtube analysis is employed, which includes the effects of wind shear. Reynolds number variations, different airfoil sections and chord lengths along the blade span, and an empirical model for dynamic stall effects. Calculations are presented for the VAWT 34-m Test Bed currently being assembled at Bushland, Texas. Time histories of the loads, as well as their Fourier spectra, are presented and discussed. An unexpected finding is that the average output power is predicted to be more sensitive to turbulence level than had previously been thought. 24 refs., 11 figs.

11385 **(SAND—87-1371C) A comparison of the predicted and measured gravitational stresses in VAWT [Vertical Axis Wind Turbine] blades.** Sutherland, H.J.; Ashwill, T.D. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 6p. (CONF-880132—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002113/JAW.

From 7. wind energy symposium; New Orleans, LA, USA (10 Jan 1988).

During the erection of the Sandia 34-Meter VAWT Test Bed, the induced gravitational stress state in the turbine blades and their associated deflections were measured. This manuscript details the measurements that were taken on the Test Bed blades during erection and compares them to the stresses and deflections predicted by the NASTRAN finite element code.

11386 **(SAND—87-1506C) Modal testing the EOLE.** Carne, T.G.; Lauffer, J.P.; Gomez, A.J. (Sandia National Labs., Albuquerque, NM (USA); Shawinigan Engineering Co. Ltd., Montreal, Quebec (Canada)). 1987. Contract AC04-76DP00789. 8p. (CONF-880132—5). NTIS, PC A02. Order Number DE88003795/JAW.

From 7. wind energy symposium; New Orleans, LA, USA (10 Jan 1988).

Modal testing an immense and flexible wind turbine poses a number of problems. It requires innovative excitation techniques since the modal frequencies of this type of structure are quite low. Also, substantial energy must be input to the structure to obtain reasonable levels of response. In this paper, the results of the modal test of the 110 m tall EOLE wind turbine are presented which had a number of modal frequencies below 1.0 Hz. Step-relaxation and wind were used to excite the structure. 5 refs., 14 figs., 2 tabs.

11387 **(SAND—87-1507C) Modal testing of a very flexible 110 m wind turbine structure.** Carne, T.G.; Lauffer, J.P.; Gomez, A.J.; Benjannet, Hassine. (Sandia National Labs., Albuquerque, NM (USA); Shawinigan Engineering Co. Ltd., Montreal, Quebec (Canada)). 1988. Contract AC04-76DP00789. 8p. (CONF-880220—9). NTIS, PC A02. Order Number DE88003796/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

Modal Testing of immense and very flexible structures poses a number of problems. It requires innovative excitation techniques since the modal frequencies of these stuctures can be quite low. Also, substantial energy must be input to the structure to obtain reasonable levels of response. In this paper, results are presented from a modal test of the 110 m tall EOLE wind turbine which had four modal frequencies below 1.0 Hz. Step-relaxation and wind were used to excite the structure. 5 refs., 14 figs., 2 tabs.

11388 **(SAND—87-1689) Analysis of wind turbines on offshore support structures excited by random wind and random waves.** Oscar, D.S.; Paez, T.L. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1988. Contract AC04-76DP00789. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004772/JAW.

A numerical approach has been developed to predict the dynamic response of structures excited by random wind and random waves, such as wind turbines at offshore locations. The software developed by this effort, called OFFSHORE HAWTDYN, calculates the displacement time response of horizontal axis wind turbines (HAWTs) attached to offshore support structures subjected to

steady and random wind and wave forces that simulate ocean environments. This software utilizes the structural dynamic analysis capability of HAWTDYN, a code developed at Sandia National Laboratories, to solve the equations of motion. The HAWTDYN code was modified to permit the application of water wave loads to the structure being analyzed. 7 refs., 22 figs.

11389 **(SERI/STR—217-3186) Wake effects in a Fayette 95-IIS wind turbine array.** Simon, R.L.; Matson, D.F.; Fuchs, J.M. (Fayette Mfg. Corp., Tracy, CA (USA); Solar Energy Research Inst., Golden, CO (USA)). Sep 1987. Contract AC02-83CH10093. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001103/JAW.

A group of 35 wind turbines on the Castello Ranch in Altamont Pass, California, was investigated to quantify array wake effects (losses in energy production due to operation of upwind turbines) and the factors influencing them. Approximately 65 hours of field measurements were made in summer 1986, with turbine energy production and wind velocity data recorded for various scenarios of array operation. Customized software and hardware were developed and installed by Fayette to facilitate these measurements. The existence of wake effects was fairly well established. Relative energy-production losses averaged 6% at the second row, when the first row was operating, and 7 to 8% at the third row, when the first two were operating. Apparently, then, the impact of the first row on the third (at a 21-rotor-diameter distance) was minimal. Ambient wind speed did not appear to affect the relative wind speed pattern within the array due to wakes, but because of the shape of the performance curve, it did affect relative energy production losses (particularly for the low-RPM mode of machine operation). The influences of ambient atmospheric conditions, such as stability, turbulence, and shear on the array wakes, were also investigated by testing over a range of the conditions available during a typical 24-hour day at the test site. None of these variables showed any significant effect on the degree of wake-induced energy losses. While the results of this study apply only to this specific array and type of wind turbine, the methodology could be applied to study wake effects at other wind farms. 6 refs., 7 figs., 20 tabs.

11390 **(SERI/TP—217-3264) Status of the special-purpose airfoil families.** Tangler, J.L.; Somers, D.M. (Solar Energy Research Inst., Golden, CO (USA); Airfoils, Inc., Hampton, VA (USA)). Dec 1987. Contract AC02-83CH10093. 9p. (CONF-871062—9). NTIS, PC A02. Order Number DE88001124/JAW.

From Windpower '87; San Francisco, CA, USA (5 Oct 1987).

This work is directed at developing thin and thick airfoil families, for rotors with diameters of 10 to 30 m, that enhance energy output at low to medium wind speeds and provide more consistent operating characteristics with lower fatigue loads at high wind speeds. Performance is enhanced through the use of laminar flow, while more consistent rotor operating characteristics at high wind speeds are achieved by tailoring the airfoil such that the maximum lift coefficient C/sub 1,max/ is largely independent of roughness effects. Using the Eppler airfoil design code, two thin and one thick airfoil family were designed; each family has a root, outboard, and tip airfoil. Two-dimensional wind-tunnel tests were conducted to verify the predicted performance characteristics for both a thin and thick outboard airfoil from these families. Atmospheric tests on full-scale wind turbines will complete the verification process. 3 refs., 7 figs., 3 tabs.

11391 **(SERI/TP—217-3276) Preliminary results from the dynamic response testing of the Westinghouse 600-kW wind turbine.** Hausfeld, T.E.; Hock, S.M.; Thresher, R.W. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1987. Contract AC02-83CH10093. 9p. (CONF-871062—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001123/JAW.

From Windpower '87; San Francisco, CA, USA (5 Oct 1987).

This paper provides a preliminary look at test data from a Westinghouse 600-kW wind turbine. The Westinghouse machine was fitted with instrumentation to record machine data, as well as wind and atmospheric conditions. Wind data were collected from five levels of anemometers mounted on a meteorological tower upwind of the turbine. Because of problems encountered while digitizing the data, this paper presents results from a very limited number of channels and time-series data segments. Three sets of 10-minute data segments are presented that cover power, pitch angle, and blade loads. Because of the narrow scope of this analysis, the following conclusions should be considered tentative: (1) Energy production appears to be somewhat better than predicted. (2) The teetering hub appears to be operating as expected, and the rotor is teetering to eliminate much of the loading caused by the mean wind shear in the inflow. (3) A large part of the flapping-moment variation is caused by low-frequency turbulence in the inflow. 2 refs., 10 figs., 4 tabs.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 10730, 10766, 10767, 10768, 11488, 11595, 11627, 11736, 12582

11382 (NEDOJ—501, pp 191-192) **Development of power generation using low calorific gas. Study on integrated coal gasification combined cycle power generation technology.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

Cold model test for collecting data necessary for fundamental design for developing a coal gasification combined cycle power generation plant having 1000 t/d coal treating capacity and of 100 MW output was performed. In relation to the work for conceptual design basing on the feasibility study performed in 1974-1979, and the fundamental design performed since 1981, following works were performed: For the fundamental design of 1000 t/d class plant: Investigation control, safety, and protection system, preparation of plan of layout, checking of heat and material balance, preparation of list of principal equipments, checking of general plan for starting and interruption of the plant: For the F/S of a 2000 MW class plant: Investigation of the control system, preparation of the overall flow sheet and layout plan, checking of consumption of power and utility at the site, list of principal equipments, characteristics of the principal equipment in the operation, characteristics of the environment, characteristics of kinds of coal, and economical matters. Further, possibility of practical use was recognized by the result of tests on pneumatic transportation, delivery, and measurement of of coal and char.

11383 **(PB—88-106836/XAB) Continuous-cooling transformation atlas for commercial power-plant materials.** Alberry, P.J.; Chew, B.; Gilmore, T.C.; Woodlands, P. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1987. 39p. (TPRD/M—1630/R87). NTIS, PC E05/MF E05.

A weld thermal simulation technique has been used to investigate the continuous-cooling transformation characteristics of a range of commercial power-plant materials. Continuous-cooling transformation data are presented for various regions of a weld heat-affected zone corresponding to single and multipass weld bead deposits. The results are discussed in terms of predictive equations describing the effects of composition on transformation temperatures.

11384 **(PB—88-109400/XAB) Recent experience of severe fouling in an oil-fired boiler.** Cunningham, A.T.S.; Gibb, J.; Jones, A.R.; Heath, G.R.; Dash, B.D. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1987. 44p. (TPRD/M—1606/R86). NTIS, PC E05/MF E05.

Color illustrations reproduced in black and white.

During 1984-85 unexpectedly severe fouling was experienced on all boiler units at Fawley Power Station. In consequence, output capacity was reduced by up to 15% and operational flexibility was severely limited. The report describes the measures taken to diagnose and treat the problem within the constraints imposed by plant design and the prevailing conditions of limited fuel availability and

high output demand. Both short-term ameliorative and longer-term diagnostic and curative measures are detailed, together with supporting engineering assessments and laboratory investigations. The result of these efforts, combined with the continuing demand from Fawley, was that previous annual output records were exceeded and the net impact of the fouling and associated operational problems was limited to a reduction of approximately 0.5% in station thermal efficiency and 5.5% in availability.

11395 **(PB—88-109673/XAB) Assessment of remanent creep life estimation methods using full-size component tests.** Hepworth, J.K.; Williams, J.A. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1987. 31p. (TPRD/M—1619/R87). NTIS, PC E05/MF E05.

A collaborative program concerned with the verification of remanent life-appraisal methods on full-size-welded components is described. Four welded 1Cr1/2Mo headers are being tested under internal pressure at 575 deg C to life fractions of 0.5, 0.75, 0.9 and to failure, respectively. Many different assessment techniques are being used to estimate remaining life, for comparison with the final vessel failure time and these are considered. Finally, the early data, particularly that for surface strains, are presented and the implications are examined.

11396 **(PB—88-115498/XAB) Study of waste-heat recovery and utilization at the Raton Public Service Company Municipal Power Plant. Technical report (Final), 22 May 1985-30 June 1987.** Cunniff, R.A. (New Mexico State Univ., Las Cruces (USA). Physical Science Lab.). Sep 1987. 137p. NTIS, PC A07/MF A01.

In this investigation, the Physical Science Laboratory examined the technical and economic feasibility of utilizing waste heat or cogenerated heat from the Raton Public Service Company Power Plant in Raton, NM. To assess the technical potential for generating hot water and electricity, a computer-simulation model was developed to evaluate turbine and system performance at a wide variety of operating conditions, including raised turbine back pressure. The RPSC funded an engineering design of a system to convert a public school building heating system to circulating hot water supplied by the power plant. A Phase I District Heating Demonstration project was evaluated.

11397 **(VTT-TUTK—372) Availability of some power plants fired with milled peat.** Kuhakoski, K.; Seppaenen, V. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1985. 108p. (In Finnish). Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

The Technical Research Centre of Finland commenced reliability monitoring of peat-burning plants in 1979. Fault and interruption reports were used to record the places at which faults occur, their causes and effects on energy production and the amount of time spent repairing them. Monthly summaries monitored the energy production of plants, the use of fuels, maintenance and reserve times of the plant and monthly averages of the humidity and other properties of the peat used. In this study the reports from 3 milled peat power plants were analyzed and the limitations of the data collected during monitoring examined. The data were supplemented by interviews carried out at the plants. Peat combustion losses (as a % of energy produced) were 1.9% at plant 1, 0.5% at plant 2 and 1.2% at plant 3. Faults in the afterburning grate accounted for 54% of the losses in peat combustion caused by plant equipment at plant 1, 39% at plant 2 and 39% at plant 3. 17 refs., 16 figs., 17 tabs.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 10745, 10746, 10747, 10748, 10767, 12542, 12600

11398 **(DOE/PC/70771—T8) Kinetics of nitrogen and sulfur reactions in combustion systems: Quarterly report No. 10.** (Energy and Environmental Research Corp., Irvine, CA (USA)). [1988]. Contract AC22-84PC70771. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88000630/JAW.

The objective of this work is to screen potential alternative mineral sorbent candidates for use downstream from convective superheater tubes and to provide a sufficient kinetic data base for incorporation of these sorbents into process models. This work will be carried out as a combined experimental/theoretical program. The resulting theory will provide an understanding of SO_2 absorption in terms of fundamental kinetic rate constants for each mineral as functions of temperature and will include the effects of the porous structure of the sorbent. This task will be divided into four subtasks: (1) mineral selection; (2) fixed bed sorbent reactivity screening; (3) entrained flow reactivity kinetics; (4) data analysis and modeling. 64 refs., 42 figs., 4 tabs.

11399 (DOE/PC/79863—T5, pp 95-101) **Model analysis of sulfur reduction technology and sulfur emission limitations.** Arey, D.; Dziegielewski, B.; Crenshaw, J.; Parker, G.; Koscianski, J. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The Coal Technology Laboratory Coal Supply and Transportation Model (CTL/CSTM) is being used to forecast the impact of the application of regulations (and potential regulations) concerning the emission of SO_2 into the atmosphere on US coal production and distribution. Options for coal-burning utilities and industries to reduce SO_2 emissions include: switching to lower sulfur coal, coal preparation, and application of combustion and/or flue gas cleanup technologies. The results of model runs reported here indicate that all strategies to reduce acid deposition by rolling back SO_2 emissions from older utility sources are likely to increase the cost of using coal by about $12 billion per year by the year 2000. Strategies which favor the application of technology as opposed to coal supply switching tend to be more effective and slightly less costly. Regional preferences for applying technology in a case in which technology costs are gradually reduced are also discussed. 2 refs., 1 fig., 3 tabs.

11400 **(OH/R—87/14/K) Sprout growth in silver maple cut at different times of the year.** Arron, G.P. (Ontario Hydro Research Div., Toronto (Canada)). 20 Feb 1987. 22p. (MICROLOG—87-04878). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A field study was initiated in 1983 to investigate the sprouting response of ten-year-old silver maple (Acer saccharinum L.) trees as a function of month (or season) of cutting. There was a significant effect of month of cutting on stump mortality determined in October 1986. Trees cut in the non-dormant season appeared to exhibit higher mortality than trees cut in the dormant season. The growth of sprouts was significantly smaller in trees cut in June, July, and August than in trees cut in October, November, and February (dormant season).

11401 **(PB—88-113485/XAB) Wall-fired boiler design criteria for dry-sorbent SO_2 control with low-NOx burners. Final report, February 1983-February 1985.** Mongeon, R.K. (Riley Stoker Corp., Worcester, MA (USA)). Sep 1987. 414p. NTIS, PC A18/MF A01.

This report assesses the impact of Limestone Injection Multistage Burner (LIMB) technology on wall-fired utility boilers for both new and retrofit designs. Recent attention has focused on dry-sorbent sulfur dioxide (SO_2) control technology which, in conjunction with low-nitrogen-oxide (low-NOx) burners, can reduce the two main acid rain precursors, SO_2 and NOx. Riley Stoker wall-fired boilers are used for the survey and compared with the entire wall-fired, coal-fired utility-boiler population. The influence of dry sorbents and staged combustion burners on boiler design was reviewed, and potential problem areas are noted. This review covers the sorbent (including storage and handling), the boiler and its appurtenances, and related flue gas cleanup and handling system.

2003 Power Transmission And Distribution

11402 **(OH/R—87/18/K) Foundation for narrow based transmission towers.** Toth, P.S. (Ontario Hydro Research Div., Toronto (Canada)). 13 Feb 1987. 26ρ. (MICROLOG—87-04883). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Single pier V2S narrow based transmission tower foundations are required to resist a shear force and overturning moment as a result of lateral loading of the transmission tower structure. This report presents the results obtained using the Fortran program PADLL (Pier Analysis and Design for Lateral Loads) to select pier size for the design loads and performance criteria for footings in Leda clay and in compact sand. Comparative analyses are offered for pier response resulting from the addition of a 4.0 m square by 2.0 m deep concrete cap to the pier and to replacement of the top 2.0 m of soil with well compacted fill. The group influence effect on four footing foundations is discussed by means of a literature review. Areas requiring further study are indicated. 8 figs., 4 tabs.

11403 **Realizations of generalized Warburg impedance with RC Ladder networks and transmission lines.** Wang, J.C. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Journal of the Electrochemical Society;* 134: No. 8A, 1915-1920(Aug 1987). Contract AC05-84OR21400.

A systematic way of constructing resistive-capacitive ladder networks and transmission lines that have a generalized Warburg impedance A(jω)/sup -n/ has been developed, where A is independent of the angular frequency ω,j = √-1, and 0 < n < 1. These realizations are believed to be useful for understanding the physical processes responsible for the above fractional-power-law dependence on frequency, which is often observed in interfacial and bulk ac response of many materials.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 11488, 11498

11404 **(IAEA-TECDOC—429, pp 81-104) Analytical techniques for monitoring water chemistry.** Elek, A.; Venkateswarlu, K.S. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Bhabha Atomic Research Centre, Bombay, India). Sep 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700803/JAW.

In Reactor water chemistry relevant to coolant-cladding interaction.

In this paper the parameters of the control and sampling points are listed for the number of power reactors in the world. This Annex is based on the responses received by the end of 1983 on the IAEA questionnaire sent in the frame of the Coolant-Cladding Interaction Coordinated Research Programme. 5 tabs.

11405 **(JAERI-M—87-126) Reactor Engineering Department annual report (April 1, 1986-March 31, 1987).** (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 245p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88751447/JAW.

Research and development activities in the Department of Reactor Engineering in the fiscal year 1986 are described. The major activities of the Department are closely related to the reactor physics of very high temperature gas-cooled reactor, high conversion light water reactor and liquid metal fast breeder reactor and to blanket neutronics of fusion reactor. Contents of this report are divided into the activities on nuclear data and group constants, theoretical methods and code development, reactor physics experiment and analysis, fusion neutronics, shielding, reactor and nuclear instrumentation, reactor control, diagnosis and robotics. The activity of the Research Committee on Reactor Physics is also included.

11406 **(NUREG—0020-Vol.11-No.9) Licensed operating reactors: Status summary report, data as of August 31, 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Dec 1987. 493p. NTIS, PC A21/MF A01 - GPO. Order Number TI88900242/JAW.

The Operating Units Status Report - Licensed Operating Reactors provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Administration and Resources Management from the Headquarters staff of NRC's Office of Enforcement (OE), from NRC's Regional Offices, and from utilities. The three sections of the report are: monthly highlights and statistics for commercial operating units, and errata from previously reported data; a compilation of detailed information on each unit, provided by NRC's Regional Offices, OE Headquarters and the utilities; and an appendix for miscellaneous information such as spent fuel storage capability, reactor-years of experience and non-power reactors in the US. It is hoped the report is helpful to all agencies and individuals interested in maintaining an awareness of the US energy situation as a whole.

11407 **(NUREG—0020-Vol.11-No.11) Licensed operating reactors: Status summary report, Data as of October 31, 1987.** Schwartz, I. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Computer and Telecommunications Services). Dec 1987. 495p. NTIS, PC A21/MF A01 - GPO. Order Number TI88900266/JAW.

The operating units status report - licensed operating reactors provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Administration and Resources Management from the Headquarters staff of NRC's Office of Enforcement (OE), from NRC's Regional Offices, and from utilities. The three sections of the report are: monthly highlights and statistics for commercial operating units, and errata from previously reported data; a compilation of detailed information on each unit, provided by NRC's Regional Offices, OE Headquarters and the utilities; and an appendix for miscellaneous information such as spent fuel storage capability, reactor-years of experience and non-power reactors in the US. It is hoped the report is helpful to all agencies and individuals interested in maintaining an awareness of the US energy situation as a whole.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 10936, 10937, 10938, 11441, 11447, 11448, 11477, 11500, 11505, 11520, 11521, 11523, 11526, 11527, 11548, 11550, 11551, 11553, 11554, 11559, 11562, 11565, 11566, 11568, 11570, 11571, 11572, 11797

11408 **(CONF-870839—8) Aging degradation of cast stainless steels: Effects on mechanical properties.** Chopra, O.K.; Chung, H.M. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003053/JAW.

From 3. international symposium on environmental degradation of materials in nuclear power systems: water reactors; Traverse City, MI, USA (30 Aug 1987).

A program is being conducted to investigate the significance of in-service embrittlement of cast duplex stainless steels under light-water operating conditions. Mechanical property data are presented from Charpy-impact, tensile, and J-R curve tests for several heats of cast stainless steel aged up to 10,000 h at 450, 400, 350, 320, and 290°C. The results indicate that thermal aging increases the tensile strength and decreases the impact energy, J/sub IC/, and tearing modulus of the steels. Also, the ductile-to-brittle transition curve shifts to higher temperatures. The fracture toughness results are consistent with the Charpy-impact data, i.e., the relative reduction in J/sub IC/ is similar to the relative decrease in impact energy. The ferrite content and concentration of C in the steel have a strong effect on the overall process of low-temperature embrittlement. The low-carbon CF-3 steels are the most resistant and Mo-containing CF-8M steels are most susceptible to embrittlement. Weakening of the ferrite/austenite phase boundaries by carbide precipitates has a significant effect on the kinetics and extent of embrittlement of the high-carbon CF-8 and CF-8M steels, particularly

after aging at temperatures ≧400°C. The influence of N content and distribution of ferrite on loss of toughness are discussed. The data also indicate that existing correlations do not accurately represent the embrittlement behavior over the temperature range 280 to 450°C, i.e., extrapolation of high-temperature data to reactor temperatures may not be valid for some compositions of cast stainless steel.

11409 **(CONF-8710111—12) Environmentally assisted cracking in light water reactors.** Shack, W.J.; Kassner, T.F.; Maiya, P.S.; Park, J.Y.; Ruther, W.E.; Kuczay, T.M.; Kasza, K.E. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002863/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Cracking in sensitized austenitic stainless steel (SS) piping and associated components in boiling water reactors (BWRs) has been observed since the mid-1960s. Proposed remedies include procedures that produce a favorable residual stress state in the weld regions, replacement of the piping with materials that are more resistant to SCC, and modification of the reactor coolant environment. During this year, studies that have important implications for all three classes of proposed remedies have been carried out. These studies include fracture-mechanics crack-growth-rate tests on Type 316 NG SS and weld overlay specimens in impurity and high-purity environments, finite-element studies on weldments treated by the Mechanical Stress Improvement Process (MSIP) developed by O'Donnell and Associates, heat-to-heat studies of SCC in alternate alloys such as Types 316 NG and 347 Mod SS, and slow-strain-rate tests for the characterization of a variety of potential reactor coolant impurities. In addition, studies on the corrosion potential of irradiated stainless steel have been performed. This work is intended to provide a better understanding of the conditions associated with irradiation-assisted SCC (IASCC) in the core region.

11410 (IAEA-TECDOC—429, pp 165-214) **Review of models describing the behaviour of corrosion products in primary heat transfer circuits of BWRs.** Ishigure, K. (Tokyo Univ., Japan. Faculty of Engineering). Sep 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700803/JAW.

In Reactor water chemistry relevant to coolant-cladding interaction.

In Part I of this annex the behavior of the corrosion products under BWR conditions is described. The description is more or less phenomenological in most parts of this chapter, and theoretical modeling of the phenomena is given only when it is reasonably applicable to present systems or appropriate to explain general phenomena. The general basic concepts and mathematical formulations employed in the computer codes which are developed to describe the behaviors of corrosion products and the radioactivity build-up in BWRs are given in Part II. 71 refs, 20 figs, 1 tab.

11411 **(INIS-mf—10767) Evaluation of operating experience for service life of components.** Schulz, H.; Sunder, R. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 32p. (In German). (CONF-871067—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751291/JAW.

From Meeting of the Society for Reactor Safety; Cologne, F.R. Germany (29 Oct 1987).

The evaluation of the operating experience of German light-water reactor components based on licensee event reports indicates that a large part of the defects and failures are caused by fatigue and/or corrosion type mechanisms. Actions have been taken to eliminate the causes by redesigning systems, replacement of components and change of operating procedures. The interaction of fatigue and corrosion mechanisms are not understood in all details today, further research is still necessary. To establish a more realistic data base of the local loading and water chemistry condition for all loading conditions the application of advanced monitoring systems is proposed. The benefits of these systems are that the operating procedures can be further optimized, the actual used life time fraction can be calculated regularly and the data base can be used for life time extension.

11412 (INIS-mf—11077, pp 205-216) **Source location and mass estimation in loose parts monitoring of LWR's.** Olma, B.J. (Gesellschaft fuer Reaktorsicherheit m.b.H., GRS, Garching, Germany, F.R.). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

To improve the diagnostics of loose parts in the primary and the secondary circuit of nuclear power plants, experimental measurements were performed in laboratory conditions and in several West German PWR's and BWR's of sound propagation in solids. The measurements aimed at improving reliability in determining the source of loose parts and the mass of such parts. The methods are described of locating the sources of loose parts based on carefully established arrival times or amplitudes of short transient signals associated with impacts of loose parts on components provided with appropriate sensors. The methods of determining the mass of loose parts are based on the Hertzian impact model. The PSD (power spectral density) spectra of impact force were calculated for various contact times within the frequency range 0 to 50 kHz. This allows differentiating the type of excitation of the structure for typical impacts of loose parts. Graphically shown are the variations of contact time and impact force with the mass of the parts and the impact velocity. (Z.M.) 16 figs., 11 refs.

11413 (INIS-mf—11077, pp 217-223) **Pressure noise utilization for surveillance in boiling water reactors.** Thie, J.A. 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Graphs, values and diagrams are shown documenting and illustrating the usability of data on pressure noise for assessing the BWR type reactor operating condition. The frequency dependence of power spectral density is shown for the Pathfinder reactor before and after loose parts occurrence in the system. Values measured at the resonance frequency of 2.6 Hz are shown for the Monticello reactor. Schematically shown are oscillation relations and reactor component resonances. Pressure noise can also be applied in in-service diagnostics of PWR type reactors. (A.K.) 4 figs.

11414 (INIS-mf—11077, pp 224-235) **Outline of development of a stability monitor for BWR/4 Caorso power plant.** Federico, A.; Ragona, R.; Parmeggiani, C.; Grifoni, S.; Tricoli, C. (ENEA, Rome, Italy; ENEL Caorso Power Station, Italy; Ansaldo S.p.A., Genoa, Italy). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Some problems are discussed of the dynamic model and of measuring the stability of BWR reactors. It is shown that the main sources of noise consist in voids and core coolant flow and pressure. The void noise cannot directly be measured. Briefly characterized are the algorithms and calculation methods for reactor stability, currently most commonly based on the multivariate autoregression modelling techniques. A design is described of a diagnostic system for reactor stability for the Italian nuclear power plant Caorso, operating on-line in real time. (Z.M.) 5 figs., 7 refs.

11415 (IWGFPT—26, pp 87-93) **Japanese study on water reactor fuel element materials and method of measurement.** Mishima, Y. (Tokyo Univ., Japan). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

So many studies have been carried out in Japan on water reactor fuel element materials and the method of measuring their properties. Some topics will be high-lighted in this report to give an idea of what they have been doing in Japan. Studies on the properties of zircaloy, including the development work for modified alloy have been performed since the late 1950s, both in fundamental work at universities and research organizations and development work for zircaloy tube commercial production in metal indus-

try. Among them, the latest work on the creep characteristics of zircaloy tubing is presented. For other material used in fuel element than cladding tube, spacer-spring will be discussed as the second topic. Reduction of spring force was carried out in Japan PWR fuel spacer to reduce rod bow in the early 1970s which could successfully eliminate the problem since 1977. Relaxation of spring force against burn-up has been discussed in the so-called reliability test program of both BWR and PWR on then-standard fuel since 1975 which was reported at Stockholm symposium in September 1986. The data obtained will be presented. As the study for the method of measurement, the author proposed a modified testing procedure for tensile and burst test for zircaloy tubing, at ASTM-B10 Committee in 1976, to emphasize the shape of mandrel in the tensile test which has a significant effect on elongation values. Various measurement techniques in post irradiation examination of water reactor fuel have been developed in Japan, among which the shadow measurement of tube during ballooning to burst will be described. 7 references, 8 figures.

11416 (KFK—4190, pp 27-30) **Decontamination in light-water reactors, techniques and experiences.** Neeb, K.H. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). Apr 1987. Special print from Atomkernenerg. Kerntech. (Aug-Sep 1986) v. 48(3) p. 181-184. (PWA—11/87; CONF-8403259—).

From Seminar on new development in the field of reprocessing; Obertraun, Austria (4 Mar 1984).

The chemical and electrochemical processes currently, available for decontamination in light-water cooled nuclear power plants are reviewed and examples for application are given. The paper points out that the process to be used has to chosen according to the special problem and that there is no process for general use. Quality assurance of the process is of paramount importance, especially concerning decontamination effectiveness and absence of possible harm to the integrity of the materials present.

11417 (NUREG—1291) **BWR [boiling-water reactor] and PWR [pressurized-water reactor] off-normal event descriptions.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Licensee Performance and Quality Evaluation). Nov 1987. 261p. NTIS, PC A12/MF A01 - GPO. Order Number TI88900201/JAW.

This document chronicles a total of 87 reactor event descriptions for use by operator licensing examiners in the construction of simulator scenarios. Events are organized into four categories: (1) boiling-water reactor abnormal events; (2) boiling-water reactor emergency events; (3) pressurized-water reactor abnormal events; and (4) pressurized-water reactor emergency events. Each event described includes a cover sheet and a progression of operator actions flow chart. The cover sheet contains the following general information: initial plant state, sequence initiator, important plant parameters, major plant systems affected, tolerance ranges, final plant state, and competencies tested. The progression of operator actions flow chart depicts, in a flow chart manner, the representative sequence(s) of expected immediate and subsequent candidate actions, including communications, that can be observed during the event. These descriptions are intended to provide examiners with a reliable, performance-based source of information from which to design simulator scenarios that will provide a valid test of the candidates' ability to safely and competently perform all licensed duties and responsibilities.

11418 (NUREG/CR—4744-Vol.2-No.1) **Long-term embrittlement of cast duplex stainless steels in LWR systems: Semiannual report, October 1986-March 1987.** Chopra, O.K.; Chung, H.M. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 49p. (ANL—87-45). NTIS, PC A03/MF A01 - GPO. Order Number TI88003538/JAW.

A program is being conducted to investigate the significance of in-service embrittlement of cast duplex stainless steels under light-water reactor operating conditions. Microstructures of cast materials subjected to long-term aging either in the laboratory or in reactor service have been characterized by various analytical techniques. The results indicate that the low-temperature embrittlement of the ferrite phase of the duplex structure is caused primarily by the formation of the Cr-rich α' phase and the Ni- and Si-rich G phase. The α' phase forms by spinodal decomposition; however, the nucleation and growth of the α' phase is very slow in the temperature range of interest. The kinetics of G-phase precipitation depend on the molybdenum and carbon content of the steel. The extent of spinodal decomposition and G-phase precipitation is strongly influenced by temperature. The variation in precipitation behavior indicates that the data obtained from accelerated aging at $\geq$ 400°C cannot be extrapolated to reactor temperatures for predicting the end-of-life fracture toughness of reactor components. Data from Charpy-impact, tensile, and J-R curve tests for several heats of cast stainless steel aged up to 10,000 h at 350, 400, and 450°C are presented. Thermal aging of the cast materials results in an increase in yield and ultimate strengths and a decrease in impact energy, J/sub IC/, and tearing modulus. The relative reduction in J/sub IC/ values of the aged materials is similar to the relative decrease in impact energy. The carbon content of the steel is an important factor in the control of the overall process of embrittlement. The influence of compositional and metallurgical parameters on impact strength and fracture mode is discussed. 21 refs., 19 figs., 5 tabs.

11419 (VTT-TIED—612) **Trends of availability performances in night water reactor units.** Lehtinen, E. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Sep 1986. 28p. Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

Availability performances of the LWR units have been analysed. The annual load factor has been used as the basic measurement in quantifying availability performances of the LWR units. The whole operating history, in the sense of the annual and cumulative load factors achieved by all Western commercial PWR and BWR units the end of 1985, has been taken into consideration. The annual load factors achieved by the WWER-440 units in the CMEA countries until the end of 1984 have been included. The total mean of the annual load factors (which is equal to the mean of all the cumulative load factors weighted by the unit age) of the PWR units since the beginning of their commercial operation was 66% up to and including 1985 (1984 by WWER-440 units in the CMEA countries), while that of the BWR units was 62%. In the preceding study some contributing factors (unit size, vintage and age) had been found that interacting with each other correlate with nuclear power plant availability performance. Accordingly some trends in the availability performance of LWR units have been identified. In this updating study the same exponential regression model was used and the coefficient of determination, R"2, increased both in the PWR units and BWR units along with the updated data base: the dependence between the availability performance and unit size, vintage and age has become still stroger. The updated regression analysis resulted additionally in that the later installed duplicate (twin) units of PWR type have generally performed better at the same age than their first-installed sister unit on the same site and better than the respective single PWR units generally. The individual cumulative load factors of all the PWR units and the BWR units at the end of 1985 (at the end of 1984 for the WWER-440 units in Bulgaria, Czechoslovakia and the Soviet Union) are presented as functions of unit size and vintage with information of site country and reactor contractor.

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REFER ALSO TO CITATION(S) 10936, 10937, 10938, 10944, 11408, 11411, 11412, 11415, 11416, 11417, 11418, 11419, 11477, 11502, 11503, 11504, 11505, 11506, 11516, 11523, 11526, 11527, 11542, 11543, 11545, 11546, 11547, 11550, 11551, 11554, 11559, 11562, 11565, 11566, 11568, 11570, 11571, 11572, 11797

11420 (CEGB-TPRD/B—0902/R87) **Analysis of oxides on a steam generator tube and clean-up circuit pipe from Loviisa 2 and the impact on assessment of cobalt sources.** Pick, M.E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1987. 25p. (PWR-CWG-P—87-345). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751464/JAW.

Results from examination of the oxide on AISI 321 stainless steel steam generator tube and clean-up circuit pipe from the Soviet designed VVER 440 Loviisa 2 PWR in Finland are presented. The oxide on the specimens has been examined by a variety of tech-

niques including alpha and gamma spectrometry, scanning electron microscopy with X-ray analysis, metallography, electron probe microanalysis, X-ray diffraction and wet chemical analysis. The oxide weight and concentrations of the major elements in the oxide, i.e. iron, chromium and nickel are similar to those on Westinghouse PWR specimens. The cobalt concentrations, however, are markedly different; there is no cobalt enrichment in the Loviisa 2 specimens, whereas Westinghouse PWR specimens show enrichment factors in the range 4-30. The concentrations of /sup 60/Co and /sup 54/Mn are also much lower on the Loviisa 2 specimens. The consequences of these results for the assessment of cobalt sources in a Westinghouse PWR are discussed.

11421 (DOE/ET/34212—54) Poolside examination of gadolinia lead test assemblies after two cycles of irradiation. Newman, L.W.; Holman, P.L.; Mayer, J.T.; Papazoglou, T.P.; Pyecha, T.D.; Aadland, P.C. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Nov 1987. Contract AC02-78ET34212. 75p. (BAW—1998). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003033/JAW.

The Babcock and Wilcox Company, Duke Power Company, and the United States Department of Energy are participating in an extended burnup project involving the irradiation and examination of an advanced fuel assembly design for pressurized water reactors. This advanced fuel assembly includes rods containing a UO_2-Gd_2O_3 fuel and burnable absorber mixture along with other design features that enhance fuel perforemance and uranium utilization such as annular pellets, annealed guide tubes, Zircaloy intermediate grids, and a removable upper end fitting. The goal of the program is to extend the burnup of preasurized water reactor fuel assemblies to a batch-average burnup of 50,000 MWd/mtU. To achieve this goal, five lead test assemblies were designed, manufactured, characterized, and inserted for irradiation in Oconee Unit 1 cycle 8. One lead test assembly received a burnup of 13,900 MWd/mtU by its discharge at the end of cycle 8; the remaining four received a burnup of 16,000 MWd/mtU after one cycle and 31,800 MWd/mtU after two cycles. These four remaining lead test assemblies are in their third cycle and are to receive a burnup of approximately 46,000 MWd/mtU by the end of Oconee Unit 1 cycle 10. To track the performance characteristics of the advanced assemblies, nondestructive examinations at poolside were conducted after each cycle of irradiation. This report contains the data collected during the poolside examination of the gadolinia lead test assemblies after their second cycle of irradiation and compares those data with the data from the pre-irradiation characterization, the first-cycle poolside examination, and the data base for the standard Mark B fuel assemblies. 28 refs., 27 figs., 15 tabs.

11422 (ENEA-RT-TERM—86-5) In service inspection of PWR steam generators. Brocco, M. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1986. 182p. (In Italian). NTIS (US Sales Only), PC A09/MF A01. Order Number TI88700996/JAW.

In the present work the experience gained in nuclear steam generators in-service inspection is reviewed. Equipment and inspection criteria are also analyzed. 37 refs.

11423 (EPRI-NP—5303M) Load-following experience in commercial PWRs: Final report. Goldstein, L.; Sheppard, K.D.; Strasser, A.A. (Stoller (S.M.) Corp., New York (USA)). Nov 1987. 23p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920102/JAW.

Some LWR operators have been concerned that load-following operations might degrade fuel performance. However, the early operating experience of 10 US PWRs suggests otherwise: A review of the plants' coolant activity and inspection data for a limited number of cycles showed that daily and weekly load-following operations had no adverse effects on fuel failure rates. 3 figs., 2 tabs.

11424 (FRNC-TH—3160) Neutronal aspects of PWR control for transient load following. Cossic, A. (Paris-11 Univ., 91 - Orsay (France)). Jan 1985. 231p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number TI88751881/JAW.

The purpose of this thesis is to qualify the CRONOS diffusion code on a load transient in grey mode control. First of all, we have established a general axial calculational model and studied the important physical phenomena: xenon oscillation, grey rods absorption, radial leaks modelling, effect of the initial conditions in Iodine and Xenon. In a second stage, a three dimensional calculation has been performed, the results of which have been compared to a PWR 900 TRICASTIN 3 experiment and have been in good agreement. In the last part, we show that the results of the axial model using one-dimensional CRONOS calculations are quite consistent with the three-dimensional calculation.

11425 (IAEA-TECDOC—429, pp 105-164) Modelling the behaviour of corrosion products in the primary heat transfer circuits of pressurized water reactors. A review of principles. Rodliffe, R.S.; Polley, M.V.; Thornton, E.W. (Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.). Sep 1987. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700803/JAW.

In Reactor water chemistry relevant to coolant-cladding interaction.

This review covers all reactors in which the primary heat transfer medium is predominantly single-phase water and in which steam is generated in a secondary circuit, i.e. including CANDU pressurized heavy water reactors (CANDU PHWR), Soviet WWERs, etc. A full appreciation of the effects of boiling and two-phase flow is necessary to extend this work to direct cycle reactors. Reviews of the formation, transport and deposition of radioactive corrosion products in PWRs have been presented by several authors (Berry and Diegle, 1979; Darras, 1980; Vanbrabant and de Regge, 1982; Gautsch, Lanza and Weisgerber, 1979). More general reviews of relevance to corrosion product fouling have also been published: fouling in heat exchangers (Epstein, 1978); corrosion products in power generating systems (Lister, 1979a); particulate fouling (Gudmundason, 1979); and precipitation fouling (Hasson, 1979). This review focusses attention on the principles which must form the basis for any mechanistic model for predicting the contamination of PWR primary circuit surfaces by radioactive corrosion products. Refs, 10 figs, 2 tabs.

11426 (INIS-BR—908) Simplified model for DNB analysis. Silva Filho, E. (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear). Aug 1979. 92p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701071/JAW.

In a pressurized water nuclear reactor (PWR), the power of operation is restricted by the possibility of the occurrence of the departure from nucleate boiling called DNB (Departure from Nucleate Boiling) in the hottest channel of the core. The present work proposes a simplified model that analyses the thermal-hydraulic conditions of the coolant in the hottest channel of PWRs with the objective to evaluate BNB in this channel. For this the coupling between the hot channel and typical nominal channels assumed imposing the existence of a cross flow between these channels in a way that a uniforme pressure axial distribution results along the channels. The model is applied for Angra-I reactor and the results are compared with those of Final Safety Analysis Report (FSAR) obtained by Westinghouse through the THINC program, beeing considered satisfactory

11427 (INIS-mf—10799) PKL-tests, series IIB (end of blowdown). Vol. 3. Test results. Final report. Mandl, R.; Umminger, K. (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 316p. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number TI88751924/JAW.

The latter stage of large break LOCA was simulated in the PKL test facility. Representative boundary conditions were achieved by preceding the refill and reflood phases with end-of-blowdown. The results confirming TRAC (Transient Reactor Analysis Code) calculations show that high steam velocity and hot leg injected accumulator water ($p<26$ bar) penetrates from the top into the core and triggers off quench fronts at both core ends. This is true of both cold-leg and hot-leg breaks. Heater rod temperature increase never amounted to more than 40 K, the turnaround time always coincided with the end of the refill phase, no temperature increase in the reflood phase was observed in tests with combined

injection. The efficiency of combined injection was shown to be independent of the break location (hot or cold leg). All tests showed the large safety margins of the current KWU-PWR desing. With 3 refs., 4 tabs., 3 figs..

11428 (INIS-mf—11077, pp 7-16) **Monitoring systems - one way to the integrity of primary coolant systems in nuclear power plants.** Stipsits, G. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Together with the so-called basic safety concept, nondestructive testing, hydraulic testing and acoustic monitoring, diagnostic systems form a complex system of measures safeguarding the integrity of the primary circuits of nuclear power plants. The application of the diagnostic systems allows reducing the scope of discontinuous testing measurements during inspection work and thus also the cost of testing and the degree of personnel exposure. Some aspects are discussed of the diagnostic systems applied in nuclear power plants in the FRG. All reactors are provided with systems for the identification of loose parts, based on noise monitoring. Currently an electromechanical calibration equipment is being developed that will facilitate the determination of loose part weight. Briefly characterized is work on the development of other diagnostic systems, this for monitoring vibrations, leaks, local cracks, and seismic effects. Computerized data processing is also discussed. It is stated that the cost of installation of these systems is low compared with that of reactor shutdown and repair of damaged equipment. The return rate of such investment is several years. (Z.M.) 3 figs., 3 refs.

11429 (INIS-mf—11077, pp 17-25) **Experimental modal analysis - an auxiliary means in reactor vibration monitoring.** Wehling, H.J.; Schuez, W.; Wiemerslage, D. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The dynamic behavior of nuclear power plant components should well be known for diagnostic monitoring of vibrations in the plants. From this point of view, the primary circuit of a nuclear power plant can be described as a system of compound masses with multiple degrees of freedom. This leads to a high number of resonances. The results are briefly discussed of tests involving forced vibrations of primary circuit components in which eigenfrequencies and shapes of vibration modes were determined for the individual components. The tests facilitated the analysis of signals of vibration diagnostic systems. Based on the knowledge of component eigenvalues, the PSD (power spectral density) spectrum peaks can be related to the source of their origin. (Z.M.) 17 figs., 4 refs.

11430 (INIS-mf—11077, pp 26-33) **KWU's reactor vibration monitoring system "SUeS".** Wehling, H.J.; Goede, D.; Sommer, R.; Stoelben, H. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The objective of the SUeS system by West German KWU is the monitoring of the mechanical condition of the primary circuit of pressurized water reactors on the basis of periodic measurements of vibrations of the individual components. Mechanical component damage is reflected in changes in the component dynamic behavior, which allows detecting the damage in its initial stage. The SUeS system primarily measures the eigenfrequencies of the components and the coolant. Their temperature dependences being different, it is necessary to reliably separate both components. The main parts of the SUeS system consist of sensors of relative and absolute displacements, pressure variations, neutron flux, and a facility for collection and processing of measured data. Up to the end of 1985, KWU supplied 14 SUeS systems to nuclear power plants in the FRG and in Czechoslovakia. The major properties are summed up of the systems and the possibilities are outlined of their use, which differ, case by case, by the number of sensors and their types. (Z.M.) 11 figs., 1 tab.

11431 (INIS-mf—11077, pp 34-40) **Operational experiences with KWU vibration monitoring systems.** Wehling, H.J.; Klingler, K.; Stoelben, H. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The eigenfrequencies of the mechanical components and of the coolant of the pressurized water reactor primary circuit can be detected and assigned to their sources from an evaluation of signals provided by diagnostic system SUeS by the West German company KWU. Component damage in its initial stage can be detected from deviations in PSD (power spectral density) spectra. Such deviations can also be due to changes in operating conditions and thus, the successful and reliable use of system SUeS depends on good knowledge of the dynamic behavior of the reactor. A typical SUeS system for a 1300 MW pressurized water reactor provides 33 signals of four types, viz,. absolute and relative displacements, pressure variations and neutron flux. Some results are reported of trial measurements of dynamic behavior of the primary circuit components of pressurized water reactors performed by KWU in the past years. (Z.M.) 16 figs., 1 ref.

11432 (INIS-mf—11077, pp 41-56) **Analysis of incore and excore neutron noise signals for a KWU PWR by correlation techniques.** Lehmann, M. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The results are reported of noise analysis of neutron flux values measured using standard instrumentation inside and outside of the pressurized water reactor in the Goesgen nuclear power plant in Switzerland. The results of measurement were compared for two operating conditions, viz., at the beginning of the fuel cycle at full reactor power and at the end of the fuel cycle at reduced reactor power involving the operation of only two out of three circulation pumps. Changes were observed in the relative motion of the core barrel and the reactor pressure vessel, such as the rotation of the plane of motion or vibration mode changes, which can be attributed to the asymmetry of coolant flow through the reactor pressure vessel. In-core measurements showed that a slight asymmetry in the coolant flow occurred in the core itself. (Z.M.) 8 figs., 10 refs.

11433 (INIS-mf—11077, pp 74-86) **Experiences of primary circuit vibration diagnostic measurements during commissioning of Paks No. 2.** Hollo, E.; Siklossy, P.; Czako, S.; Kiss, I.H. (Institute for Electric Power Research, Budapest, Hungary; Paksi Atomeroemue Vallalat, Hungary). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Some results are reported of measuring the dynamic characteristics of the primary circuit during the reactor start-up of the second WWER-440 unit of the Hungarian Paks nuclear power plant. The instrumentation is described and the placement is schematically shown of the sensors on major components. The objective of the measurement was to determine the behavior of the main circulation pumps in transients during start-up and shutdown as well as the vibration characteristics of the pumps in the steady-state mode, the effect of feed water level on steam generator vibrations, and the overall dynamic behavior of the primary circuit at different reactor power (35, 50, 75 and 100%). The results of measurement in form on PSD (power spectral density) spectra are shown grahically; in a number of cases, analogous results are shown for comparison of the first unit of the Paks nuclear power plant. (Z.M.) 1 tab., 9 figs.

11434 (INIS-mf—11077, pp 87-97) **On some consequences of the low-frequency splitting on the calculated neutron-temperature CPSDs.** Kozma, R. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Monitoring thermodynamic anomalies in the reactor core is an important element of the safety analysis of nuclear power plants. The low frequency range is of extraordinary importance for this purpose when noise effects are used. The results are discussed of calculating neutron and temperature PSD (power spectral density) spectra for a WWER-440 reactor using a theoretical model; the model is briefly described. The calculations were performed for two cases, viz., for a core operating under normal conditions and for a core in which a small void of a volume of 1% is provided. (Z.M.) 7 figs., 15 refs.

11435 (INIS-mf—11077, pp 98-108) **Theoretical investigations of the neutron noise caused by low-frequency pressure fluctuations in PWRs.** Katona, T. (Paksi Atomeroemue Vallalat, Hungary). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

A mathematical model is constructed serving the diagnostics of mechanical integrity of the internals of a pressurized water reactor pressure vessel. The model allows determining the effect of low frequency pressure fluctuations on neutron noise signals and to obtain information on mechanical integrity of the reactor internals. In view of the fact that the relationship between pressure fluctuations on the one hand and the mechanical condition, thermohydraulic conditions and neutron kinetics in the core on the other are very complex, several components in the neutron noise signal are dependent on pressure fluctuations. The pressure fluctuations, e.g., are associated with the vibrational motion of the core barrel, fuel assembly vibrations, and the fluctuations of the thermohydraulic conditions in the core. The mathematical model presented does not consider the effect of motion of fuel assemblies. The effect of this phenomenon will be subject to further development of the model described. (Z.M.).

11436 (INIS-mf—11077, pp 109-118) **Coupling of neutron and temperature noise signals at boiling conditions in PWRs.** Collatz, S.; Rindelhardt, U. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

An experimental programme was performed on the reactor of the Rheinsberg (GDR) nuclear power plant within the study of local boiling in pressurized water reactors. Special fuel assemblies were used provided with sensors for measuring neutron flux, temperature and pressure. Neutron noise measurements showed typical local effects within 2 and 20 Hz, which are known for boiling water reactors. Some results of the measurements are shown in graphs. Based on the experimental results, a theoretical model was developed describing the spatial dependence of neutron noise low frequency components. The model, which is described in detail, considers identical primary noise sources (inlet coolant temperature fluctuations, coolant flow and reactor power fluctuations) for temperature fluctuations within the single-phase flow range and for the contribution of voids in the two-phase flow range. The comparison of results of theoretical calculations using the model described and of experimental measurements shows satisfactory agreement. (Z.M.) 3 figs., 5 refs.

11437 (INIS-mf—11077, pp 119-136) **Coolant temperature noise sources investigations in a PWR.** Werner, M. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Within the study of temperature noise sources in the pressurized water reactor coolant, a number of measurements was performed on the Rheinsberg (GDR) nuclear power plant reactor, using experimental fuel assemblies. The fuel assemblies were provided with special temperature sensors and allowed inducing and studying local coolant boiling processes of different intensities. The main results of the temperature noise analysis are shown in graphs. A theoretical model was constructed using the results of the experiments, describing temperature fluctuations in the core in single-phase and two-phase flow situations. The changes are discussed of temperature noise in the subcooled boiling situation and in bulk boiling. The model allows determining the type of boiling in the core from the parameters of measured noise. An analysis of coolant temperature noise signals allows identifying cases of single-phase flow, subcooled boiling and bulk boiling. (Z.M.) 6 figs., 10 refs.

11438 (INIS-mf—11077, pp 137-141) **Effects of fuel element vibrations on spectral density of neutron flux fluctuations in PWR's.** Meyer, K. (Ingenieurhochschule Zittau, German Democratic Republic. Sektion Kraftwerksanlagen und Energieumwandlung). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

A mathematical model is described in detail allowing the determination of the effect of fuel element vibration on the coefficient of availability of thermal neutrons in pressurized water reactors. The model is based on the well-known fact that low-amplitude vibrations of fuel elements may lead to resonances in the neutron flux fluctuation spectrum. The amplitude of thermal neutron flux disturbances depends on the boron concentration in the moderator, similar to fuel element vibrations. (Z.M.) 5 refs.

11439 (INIS-mf—11077, pp 154-174) **Autoregressive model fitting algorithms based on least squares method and its application to noise analysis of Borssele reactor.** Hayashi, K. (Netherlands Energy Research Foundation, Petten; Japan Atomic Energy Research Inst., Tokyo). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The paper topic is not presented as a continued text but as a list of thoughts, formulae, equations, interrelations as is usual for slides prepared for projection during a lecture. Thus, two conventional methods are dealt with for the construction of fitting algorithms for an autoregressive model, viz., the Yule-Warker and the Burg methods, and especially two methods based on the least square fit, the Marple and the Kitagawa-Akaike methods. The formulae and equations presented allow comparing the properties of the four algorithms which are also described by a number of results presented graphically. Graphically shown are also the results of the aplication of the autoregressive model after Marple to the noise spectrum of the Borssele reactor. (A.K.) 20 figs., 3 refs.

11440 (INIS-mf—11077, pp 246-250) **Modal analysis of tubes in a tube bundle of WWER steam generator.** Urbanek, M.; Rybak, M.; Matal, O.; Rybnicek, J.; Plsek, J. (Vyzkumny Ustav Energetickych Zarizeni, Brno, Czechoslovakia). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Vibration mode parameters of WWER steam generator tubes were measured using test stands. The objective was to determine damping characteristics for the cases with water and without water in the tubes and a water-steam mixture outside the tubes. The tests were performed using an experimental bundle of nine U-tubes of 16x1.4 mm in size; the tube mounting corresponded to the actual situation, i.e., the tubes were fitted by means of six support lattices spaced 0.7 m. The main conclusions of the tests show that water inside the tubes shifted the tube resonance frequency by about 9% towards lower values and that primary water pressure changes did

affect neither the resonance frequency nor the tube damping ratio coefficient. The finding is important for dynamic tube load analysis that the presence of secondary water on the one hand increased the relative damping ratio coefficient and on the other shifted the tube resonance frequency towards lower values. (Z.M.) 5 figs.

11441 (INIS-mf—11098) **Nuclear power buildings.** Chalus, Z.; Cihlar, M.; Felt, J. (Ceskoslovenska Komise pro Atomovou Energii, Prague; Vyzkumny Ustav Pozemnich Staveb, Prague, Czechoslovakia; Energoprojekt, Prague, Czechoslovakia). (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1985. 200p. (In Czech). NTIS (US Sales Only), PC A09/MF A01. Order Number TI88701082/JAW.

English translation available from Nuclear Information Center, 156 16 Prague 5-Zbraslav, Czechoslovakia at US$ 10 per page. .

The problems of building work associated with the construction of nuclear power installations including infrastructure are thoroughly analyzed. Attention is paid to all stages, starting from feasibility studies to project design, the preparation of the site and infrastructure, to the construction of the individual buildings of nuclear power plants, basic building materials and the technology of their preparation. Emphasis is placed on special technical solutions of the building of nuclear power plants. Experience from the construction of nuclear power plants in Czechoslovakia and abroad covers the period till the end of 1983. (Z.M.). 5 tabs., 206 figs., 130 refs.

11442 (IWGFPT—26, pp 21-27) **Stress corrosion and fatigue corrosion of Zircaloy in iodine environment.** Lemaignan, C.; Schuster, I. (CEA Centre d'Etudes Nucleaires de Grenoble, 38, France). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

As pellet cladding interaction (PCI) limits the performance of PWR fuel rods, the mechanisms of cladding failure by PCI must be intensively studied. It is commonly accepted that it involves a stress corrosion cracking (SCC) phenomenon induced by iodine created during fission. To complement standard SCC tests performed on different cladding tubes in order to observe crack growth rate, the crack initiation step was analysed by simulation using irradiation by heavy ions: after irradiation with ^{84}Kr at 97.5 MeV to a dose of $8x10^{14}$ ions cm^{-2}, severe surface embrittlement was observed on stress relieved Zry4 cladding tubes; on the other hand, this effect was less significant on pure recrystallised Zr plate. This observation is discussed with respect to the use of Zr liner as a PCI remedy. Due to the increasing tendency towards load-following operation, fatigue behaviour must be analysed. As the existence of I-SCC induces the possible occurrence of a Zry fatigue corrosion phenomenon under the same environment conditions, fatigue crack growth rate and fatigue life measurements were carried out on RX Zry4 plates. They show a drastic reduction in fatigue resistance when iodine is present. The results of fatigue corrosion tests and fractography can be analysed as a grain-to-grain association of I-SCC and standard crack growth, depending on grain orientation. 14 references, 8 figures.

11443 (IWGFPT—26, pp 39-43) **Fragema Zircaloy cladding behaviour in French PWR.** Lavoine, O.; Raybaud, A.; Houdaille, B.; Ravier, G. (Electricite de France, Villeurbanne; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France; Framatome, Lyon, France). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

For several years, EDF, Fragema and CEA, with the cooperation in some cases of Westinghouse, have developed R and D programs to study the fuel behaviour under reactor operating conditions. These programs include dimensional on-site examinations and physical hot cell examinations of fuel rods. An important objective of these programs is a better understanding of the zircaloy cladding behaviour under irradiation. In this paper, the cladding growth and corrosion are presented. 2 references, 8 figures.

11444 (IWGFPT—26, pp 44-47) **Irradiation growth and strength of Zirconium alloys.** Garzarolli, F.; Dewes, P.; Manzel, R.; Juettner, A. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

Irradiation growth of Zircaloy and zirconium base alloys was studied in PWRs for up to four operational cycles, corresponding to fast neutron fluences of about $9x10^{21}$ cm^{-2} ($E > 0.82$ MeV). For standard Zircaloy tubing there exists a strong interrelation between irradiation growth and as-fabricated yield strength. Higher yield strength usually results in higher growth. An effective means of reducing irradiation growth is final β-quenching of the tubing. A combination of high yield strength and low irradiation growth can be achieved by β-quenching and subsequent cold working. Zr 2.5 Nb shows a significantly smaller growth rate even at high yield strength compared to Zircaloy. 5 references, 4 figures, 2 tables.

11445 (IWGFPT—26, pp 48-52) **Corrosion of Zircaloy-4 fuel cladding in conditions simulating extended burn-up in PWR.** Tice, D.R.; Huddart, G. (UKAEA Springfields Nuclear Power Development Labs.). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

The possibility of increased corrosion of Zircaloy-4 fuel cladding due to hideout of lithia at the extended fuel burn-ups now being proposed for pressurised water reactors is being investigated. The test programme includes isothermal testing in simulated start-of-cycle coolant chemistry, and in a high lithium/boron environment simulating that which might be produced under heat flux conditions due to hideout of lithium and boron compounds in porous oxide or crud. Tests under heat flux conditions with local boiling are planned, to investigate the conditions which might result in hideout in practice. The present paper presents results of the isothermal test after one year's specimen exposure. These results show no significant difference between corrosion rates in PWR coolant and in the simulated hideout environment prior to the transition from cubic to approximately linear kinetics, but a small degree of acceleration of corrosion in simulated hideout conditions is observed subsequently. There are also differences between the various environments in the extent of lithium incorporation in the oxide film. Specimen exposures have not yet reached the time at which the greatest effect of the environment would be expected. 7 references, 5 figures, 1 table.

11446 (IWGFPT—26, pp 53-59) **Evolution of Zr-Nb base alloys for LWR fuel clads.** Grigoriev, V.M.; Nikulina, A.V.; Peregud, M.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Institute Neorganicheskikh Materialov, Moscow, USSR). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

The properties of Zr-1% Nb-0,13% O_2 and Zr-1% Nb-1%Sn-0,5% Fe alloys as fuel clads have been investigated in comparison with the properties of Zr-1% Nb. The investigation included short-term mechanical and creep tests, definition of tendency to uniform corrosion, hydrogen pick-up and iodine corrosion cracking. Tests were carried out under out- and in-pile conditions. 11 references, 7 figures, 1 table.

11447 (IWGFPT—26, pp 60-69) **Advanced experimental techniques for post-irradiation examination of LWR fuel rods.** Schoenfeld, H.; Manzel, R.; Wuertz, R. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

Today post-irradiation examinations are performed to extend the data base to higher target burnups, to determine performance

limitations and to characterize new fuel types (e.g. U/Pu-oxide, U/Gd-fuel). After a survey of the post-irradiation examination techniques applied by KWU in the spent fuel pool and the Hot Cells a description will be given of some new Hot Cell techniques for a more in depth characterization of the fuel: fuel density measurement, micro-coring, micro-gammascanning, open porosity determination, SEM-examination. 4 references, 8 figures, 2 tables.

11448 (IWGFPT—26, pp 69-76) **Cermamographic techniques and electron probe micro-analysis applied to uranium-plutonium oxides.** Lippens, M.; Loon, C. van; Ketels, J. (Societe Belge pour l'Industrie Nucleaire, Brussels, Belgium; Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

Feasibility of plutonium recycling in LWRs is a reality in Europe. This result has been obtained by BELGONUCLEAIRE through constant progresses made in the field of uranium-plutonium mixed oxide (MOX) fuel fabrication, of neutronic calculations, and of fuel rod design. These efforts were supported by an extensive programme of demonstration in PWRs and BWRs, associated to postirradiation examinations focused on neutronic, thermomechanical and microstructural behaviour of MOX fuels. The present paper aims to describe typical characteristics of the microstructural evolution under irradiation of the MOX fuel prepared by mechanical blending of the UO_2 and PuO_2 powders. The first part of the paper describes briefly the MOX microstructure before irradiation; the second part deals with basic conclusions of the demonstration programme and illustrates the postirradiation MOX microstructure revealed by the ceramographic and microprobe techniques. Finally, further developments on the MOX fuel are summarized. 8 figures.

11449 (IWGFPT—26, pp 94-102) **Effect of reference parameters and properties of materials for WWER-type fuel elements on their reliability.** Bibilashvili, Yu.K.; Malachenko, L.L.; Medvedev, A.V.; Solyany, V.I.; Sukhanov, G.I.; Tonkov, V.Yu. (Vsesoyuznyj Nauchno-Issledovatel'skij Institute Neorganicheskikh Materialov, Moscow, USSR). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

Present approach to requirements for reference parameters and properties of materials for WWER-1000 fuel elements is presented as well as evaluation of their effects on fuel reliability. Some results of investigations with the aim of improving fuel element reliability in operational NPP conditions are discussed. 4 references, 7 figures, 3 tables.

11450 (IWGFPT—26, pp 115-117) **Performance analysis of WWER-440 type fuel elements with high burnups.** Karl, H.; Reinfried, D.; Steinkopff, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

According to present knowledge optimum utilization of fuel in the WWER-440 type reactor is reached at a mean discharge burnup of 45 up to 50 GWd/tU using an annual refuelling cycle. This optimum can only be achieved with a refuelling fraction of about 1/5 and an enrichment of the new fuel of about 4.4%. By means of burnup calculations carried out for this mode of operation, peak values for the mean and local burnup of a fuel element have been found to be about 60 GWd/tU and 67.5 GWd/tU, respectively. In this paper the results of model calculations on the operating performance of this fuel element are presented and discussed. 5 references, 2 figures, 1 table.

11451 (IWGFPT—26, pp 118-126) **Results of MR experiments on ten years irradiation of experimental uranium dioxide zirconium-clad fuel elements.** Goncharov, V.V.; Dubrovin, K.P.; Ivanov, E.G.; Kruglov, A.B.; Shesternin, V.A. (Institute Atomnoj Ehnergii, Moscow, USSR). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

The report presents the results on investigation of the experimental fuel elements with uranium dioxide and claddings made of 1% Nb-Zr alloy. Investigations were carried out in the I.V. Kurchatov Institute of Atomic Energy in Moscow. The experimental fuel elements have been irradiated in the MR reactor for about 10 years in boiling, neutral, uncorrected water-chemical regime with the steam quality up to 8.6 wt. %, at linear ratings up to 600 W/cm, at numerous changes of power and temperature (about 600 cycles), up to a maximum fuel burn-up of 91.4 MW.d/kgU. The design of experimental fuel elements and assembly and in-pile test conditions are described in the report; the results of investigations are given, including neutron radiography of fuel elements, gamma-scanning, measurement of geometrical dimensions and volume of gas fission products released inside the cladding, the metallography and ceramography, determination of the mechanical properties of claddings. 7 figures, 4 tables.

11452 (NUREG/CR—3320-Vol.4) **LWR [light water reactor] Pressure Vessel Surveillance Dosimetry Improvement Program: PSF [Poolside Facility] Metallurgy Program.** McElroy, W.N.; Gold, R. (eds.). (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1987. Contract AC06-87RL10930. 366p. (HEDL-TME—87-4). NTIS, PC A16/MF A01 - GPO. Order Number TI88003375/JAW.

This document supports analysis of the Poolside Facility experiments and blind test and provides experimental conditions, as-built documentation, and final metallurgical data on measured property changes in different pressure vessel steels in the PWR pressure vessel wall mockup. (JDH)

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 11441, 11515, 11524, 11528, 11529, 11530, 11531, 11532, 11533, 11534, 11535, 11536, 11553, 11555, 11556, 11557, 11558, 11559, 11560, 11561, 11572, 12517, 12660, 12681, 12682

11453 (CONF-8711106—1) **Gas erosion of impeller housing in the operation of a high-temperature, high-pressure helium circulator.** Sanders, J.P.; Heestand, R.L.; Young, H.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002607/JAW.

From Meeting on gas-cooled reactor coolant circulator and blower technology; San Diego, CA, USA (30 Nov 1987).

Three gas-bearing circulators are installed in series in a high-pressure, high-temperature loop to provide helium flow up to 0.47 m^3/s at a total head of 78 kJ/kg. The design pressure is 10.7 MPa, and temperatures of 1000°C can be obtained in the test section. The inlet temperature to the circulators is limited to 450°C. During a routine examination of the circulator, deep V-shaped grooves were found in the stationary surface of this cavity. At the same time, a very fine, dark particulate was observed in crevices of the housing. At first it was assumed that the grooves were formed by particulate erosion; however, examination of the grooves and discussions with persons experienced with large circulator operation changed this opinion. Erosion caused by particulate is characteristically rounded on the bottom and has a greater width to depth aspect than the V-shaped grooves, which were observed. Analysis of the particulate indicated that it was essentially the material of the housing that had undergone reactions with impurities in the circulating gas. It was subsequently concluded that the impeller housing had not been heat treated in a sufficiently oxidizing atmosphere after machining to form an adherent oxide coating. This suboxide coating was eroded by the shear forces in the gas. The exposed layer of metal was then

further oxidized by the impurities in the gas, and these layers of oxide were successively eroded to produce the grooves. This erosion problem was eliminated by machining a ring of the same material, heat treating it to form an adherent stable oxide, and bolting it in place in the cavity.

11454 (CONF-8711106—2) **Operating experience with gas-bearing circulators in a high-pressure helium loop.** Sanders, J.P.; Gat, Uri; Young, H.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01; 2; GPO Dep. Order Number DE88002606/JAW.

From Meeting on gas-cooled reactor coolant circulator and blower technology; San Diego, CA, USA (30 Nov 1987).

A high-pressure engineering test loop has been designed and constructed at the Oak Ridge National Laboratory for circulating helium through a test chamber at temperatures to 1000°C. The purpose of this loop is to determine the thermal and structural performance of proposed components for the primary loops of gas-cooled nuclear reactors. Five MW of power is available to provide the required gas temperature at the test chamber, and an air-cooled heat exchanger, rated at 4.4 MW, serves as a heat sink. This report contains results of tests performed on gas-bearing circulators.

11455 (Juel-Spez—388(v.1)) **Methodology of comprehensive probabilistic safety analyses for future HTR-concepts. A status report. Vol. 1. Event sequences, system reliability, release frequencies.** Hennings, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). May 1987. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88751961/JAW.

This series of reports establishes the status of the risk analysis methodology in order to increase the comparability of the analyses being under way for the HTGR concepts 'HTR-100', 'HTR-500' and 'HTR-Modul'. The volume at hand deals with the subject 'event sequence and reliability analyses'.

11456 (Juel-Spez—388(v.3)) **Methodology of comprehensive probabilistic safety analyses for future HTR-concepts. A status report (1986). Vol. 3. Fission product release.** Moormann, R.; Verfondern, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). May 1987. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number TI88751962/JAW.

This report makes the attempt to summarize the state of knowledge with respect to the modeling of fission product release in HTR, and to define a suitable proceeding for the pre-phases of the safety analyses for HTR-100, HTR-Modul, and HTR-500. The behaviour of relevant fission product nuclides during normal operations and its release trails during the 'classical' HTR accident scenarios core heatup, water ingress, and depressurization (including the accidental impact on the surroundings) are considered. For describing most of the essential stations of the release trail, calculation models and corresponding input data are existent. Incomplete knowledge in this field is specified as a point of further research.

11457 **Compact nuclear power systems based on particle bed reactors.** Horn, F.L.; Powell, J.R.; Steinberg, M.; Takahashi, H. (Brookhaven National Lab., Upton, NY 11973). pp 202-205 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract AC02-76CH00016.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

Compact, low cost nuclear power systems with an extremely low radioactive inventory are described. These systems use the Particle Bed Reactor (PBR),in which HTGR particle fuel is contained in packed beds that are changed daily. The small diameter particle fuel (500 μm) is directly cooled utilizing the large heat transfer area available (7.8 m/sup 2//liter), thus allowing high bed power densities (MW/liter).

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 11072, 11425, 12600

11458 (IWGFPT—26, pp 27-38) **Environment induced cracking of Zircaloy-2 fuel cladding tube.** Ghosal, S.K.; De, P.K. (Bhabha Atomic Research Centre, Bombay, India). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

This paper is based on some studies on the influences of iodine vapour and cadmium on pellet clad interaction (PCI)/stress corrosion cracking (SCC) of different types of zircaloy 2 fuel cladding tubes bare, graphite coated, preoxidized and prehydrided meant for use in pressurized heavy water reactors (PHWR). Experiments were conducted using the internal pressurization technique and the hoop stress applied on the tube was varied from 16 kg/mm^2 to 37 kg/mm^2 at temperatures 573 K to 773 K. Iodine concentration inside the tube was maintained at 1 to 10 mg/cm^2. The susceptibility to SCC of the bare tubes increased with increasing iodine concentration, stress level and temperature. The applied stress at which SCC occurred was close to the yield stress of the material and was virtually independent of the iodine content. Depending on the applied stress, the tubes fractured either by pin-hole damage or by complete bursting with only 5-10% circumferential strain. The graphite coated and the preoxidized tubes demonstrated enhanced resistance to SCC failure. The life of graphite coated tubes was more than 10 times longer as compared with that of uncoated tubes at 673 K in the presence of 1 mg/cm^2 of iodine. The life time of graphite coated tubes under simulated power ramp conditions, in which the temperature was raised suddenly from 573 K to 773 K, was seen to be about 1.5 times longer than that of bare tubes. Cadmium, when in direct contact with zircaloy surface (as in the case of acid cleaned tubes), promoted embrittlement. In the presence of both cadmium and iodine, a strong influence of the applied stress was noticed. Localised attack, such as pitting, was detected on the inside surface of those tubes which failed by iodine-SCC. The presence of corrosion products on or near the fracture surface suggested a chemical interaction of iodine with the cladding surface. 30 references, 10 figures, 4 tables.

11459 (IWGFPT—26, pp 103-115) **Prediction of the influence of material properties on fuel rod behaviour.** Harriague, S.; Aguero, D.; Lopez Pumarega, J.; Marino, A. (Comision Nacional de Energia Atomica, Buenos Aires, Argentina). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

There is an increasing interest on the influence of materials properties on fuel rod behaviour under constant power, power ramping and load-following operation of a nuclear power plant. Analytical tools are required in order to determine the effect of the modification of given material properties, as well as to analyze actual irradiation behaviour and PIE results. CNEA has developed the BACO Code for the analysis of fuel rod behaviour under irradiation. Its modular structure and detailed coupling of thermo-mechanical and irradiation induced phenomena makes it an interesting tool for the prediction of the influence of material properties on the fuel rod performance and integrity. In this paper, we present a study of the effect of some material properties - i.e. fuel porosity, densification, Zircaloy mechanical properties and anisotropy, among others - on fuel rod behaviour. The study covers constant power, and power ramping. Power ramping due to fuel reshuffling in HWRs is specially analyzed, as well as the influence of ramp velocity and pre-conditioning on the fuel rod integrity. A brief discussion is included regarding the interrelation between basic fuel design, material properties, operating conditions and fuel integrity. 12 references, 20 figures, 1 table.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 11057, 11517, 11519, 11537, 11554, 11567, 11576, 11580

11460 (CONF-871101—76) Thermal conductivity of $Na_3(U/sub\ 1\text{-}y/Pu/sub\ y/)O_4$: A preliminary in-pile determination. Lee, M.J.; Lambert, J.D.B.; Ukai, S.; Odo, T. (Argonne National Lab., IL (USA); Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003034/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

During Run-Beyond-Cladding-Breach (RBCB) operation in an oxide LMR, the performance of a breached fuel element is intimately associated with the formation of fuel-sodium reaction product (FSRP), $Na_3(U/sub\ 1\text{-}y/Pu/sub\ y/)O_4$. In-pile experiments coupled with destructive examinations of breached fuel have consistently revealed noticeable changes in fuel structure accompanying FSRP formation at the fuel surface. Previous analyses have also indicated a significant impact of FSRP on fuel centerline temperature. Successful modeling of breached fuel thermal behavior therefore requires a reasonably accurate knowledge of the thermal properties of the FSRP, especially its thermal conductivity. But laboratory investigations have been scarce and limited to the Na_3UO_3 system because of the toxicity of plutonium and hygroscopicity of the FSRP. Hence, post-irradiation observations of fuel samples remain the most amenable way of deriving the thermal conductivity of the FSRP. Such work is a spin-off of the RBCB program in the Experimental Breeder Reactor-II (EBR-II), a program jointly sponsored by the US Department of Energy and the Power Reactor and Nuclear Fuel Development Corporation of Japan.

11461 (CONF-8707134—1) The integral fast reactor concept. Chang, Yoon I.; Marchaterre, J.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002921/JAW.

From USSR/US specialists' meeting in the field of advanced liquid metal reactors; No City Given, USSR (27 Jul 1987).

The Integral Fast Reactor (IFR) is an innovative liquid metal reactor concept being developed at Argonne National Laboratory. It seeks to specifically exploit the inherent properties of liquid metal cooling and metallic fuel in a way that leads to substantial improvements in the characteristics of the complete reactor system. The IFR concept consists of four technical features: (1) liquid sodium cooling, (2) pool-type reactor configuration, (3) metallic fuel, and (4) an integral fuel cycle, based on pyrometallurgical processing and injection-cast fuel fabrication, with the fuel cycle facility collocated with the reactor, if so desired. This paper gives a review of the IFR concept.

11462 (CONF-8709193—2) Metallic fuel development. Walters, L.C. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002857/JAW.

From US/USSR specialist meeting on fast reactor core components; Richland, WA, USA (8 Sep 1987).

Metallic fuels are capable of achieving high burnup as a result of design modifications instituted in the late 1960's. The gap between the fuel slug and the cladding is fixed such that by the time the fuel swells to the cladding the fission gas bubbles interconnect and release the fission gas to an appropriately sized plenum volume. Interconnected porosity thus provides room for the fuel to deform from further swelling rather than stress the cladding. In addition, the interconnected porosity allows the fuel pin to be tolerant to transient events because as stresses are generated during a transient event the fuel flows rather than applying significant stress to the cladding. Until 1969 a number of metallic fuel alloys were under development in the US. At that time the metallic fuel development program in the US was discontinued in favor of ceramic fuels. However, development had proceeded to the point where it was clear that the zirconium addition to uranium-plutonium fuel would yield a ternary fuel with an adequately high solidus temperature and good compatibility with austenitic stainless steel cladding. Furthermore, several U-Pu-Zr fuel pins had achieved about 6 at.% bu by the late 1960's, without failure, and thus the prospect for high burnup was promising.

11463 (CONF-8709204—1) Pattern-recognition software detecting the onset of failures in complex systems. Mott, J.; King, R. (EI International, Inc., Idaho Falls, ID (USA); Argonne National Lab., Idaho Falls, ID (USA)). 1987. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002861/JAW.

From 42. meeting of mechanical failures prevention group; Gaithersburg, MD, USA (15 Sep 1987).

A very general mathematical framework for embodying learned data from a complex system and combining it with a current observation to estimate the true current state of the system has been implemented using nearly universal pattern-recognition algorithms and applied to surveillance of the EBR-II power plant. In this application the methodology can provide signal validation and replacement of faulty signals on a near-real-time basis for hundreds of plant parameters. The mathematical framework, the pattern-recognition algorithms, examples of the learning and estimating process, and plant operating decisions made using this methodology are discussed. The entire methodology has been reduced to a set of FORTRAN subroutines which are small, fast, robust and executable on a personal computer with a serial link to the system's data acquisition computer, or on the data acquisition computer itself.

11464 (ENEA-RT-TIB—85-26) Geres-A code to process MC/sup 2/ II data for heterogeneous fast reactor cell calculations. Galli, M. (ENEA, Bologna, Italy. Dipt. Tecnologie Intersettoriali di Base). (ENEA, Rome (Italy)). 1985. 68p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701275/JAW.

This report is the user manual of the GERES code. This code has been written at ENEA-CRE-CLEMENTEL to permit a fast and accurate analysis of the effect of fast reactor cell heterogeneity. The code produces broad-group resonance cross sections for each zone of the reactor cell, utilizing ultra-fine-group cross sections and resonance integrals produced by the MC/sup 2/-II code. The code sequence of which this code is a part is described in this report, as well as the input and structure of the GERES code. To show the main features of the code the analysis of a simplified reactor cell is included. 20 refs.

11465 (FEI—1680) By-channel calculation of temperature fields in opposite-directional wire wrapped fuel rod bundles in fast reactors. Kazachkovskij, O.D.; Bogoslovskaya, G.P.; Zhukov, A.V.; Sorokin, A.P.; Titov, P.A.; Ushakov, P.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701004/JAW.

Methods of by-channel thermal-hydraulic calculation of fuel assemblies (FA) in fast reactors with opposite-directional wire wrapped fuel rod bundles are presented. The TEMP-R FORTRAN program in which the methods are realized, is described in brief. Intensity of interchannel heat transfer in FA with opposite-directional wrapped wires is analysed. Agreement between the results of the temperature field calculation in model FA and experimental data is shown. Results of calculation of temperature fields in the BN-1600 reactor core with one-directional and opposite-directional wrapped wires show, that the intensification of interchannel transfer due to opposite-directional wrapped wires results in a certain decrease of maximal temperature of fuel cans and maximal variation of the temperature around FA perimeter. 17 refs.; 8 figs.

11466 **(FEI—1816) Thermophysical justification of temperature conditions for fast reactor fuel assemblies accounting for hot spot factors. Hydrodynamics of fast reactor fuel assemblies.** Zhukov, A.V.; Sorokin, A.P.; Ushakov, P.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 68p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701017/JAW.

Short information of investigations of Soviet and Czechoslovakian specialists into fast reactor thermal physics is given, actuality of investigation into fuel assembly (FA) abnormal operating modes is pointed out. Factors determining shaping of rate and temperature fields in FA during the reactor operating cycle under normal and abnormal operation conditions are classified. Specific features of fast reactor FA geometry are described. Results of investigations into local (rate distributions, tangential stress, turbulent microstructure) and averaged (hydraulic resistance coefficient, expenditures) hydrodynamic characteristics in fast reactor FA obtained owing to aerodynamical and electromagnetic measurements on models are stated. Generalizing formulae for calculating the hydraulic resistance coefficients in smooth rod clusters and wire wrapped fuel rods have been derived as a result of analysis and generalization of data obtained in different investigations. 68 refs.; 46 figs.

11467 **(INIS-mf—11077, pp 175-182) ARMA modeling and bootstrap technique for accuracy evaluation of parameters of interest in nuclear reactor field.** Marseguerra, M.; Porceddu, C.M. (Politecnico di Milano, Italy; ENEA, Bologna, Italy. Centro Ricerche Energia). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

With scarcity of information on the probability distribution of recorded signals, the accuracy of required parameters can be determined using the bootstrap method which can be applied even if only a simple, brief record is available. The application is briefly described of the method in reactor technology. The method was first tested by simulating a time series with known coefficients and an exponential white noise with zero mean value and assigned fluctuation. Preliminary results were obtained by 150-fold application of the bootstrap method to samples of 50 and 75 values. In the second stage, the method was tested on a temperature time series of data measured with a small thermocouple of 0.5 mm in diameter on a model of the fuel assembly of the Superphenix fast reactor. The objective was to determine the accuracy of the skewness coefficient which can be used as an indicator of radial temperature course modifications. (Z.M.) 6 refs., 1 tab., 8 figs.

11468 **(INIS-mf—11077, pp 236-245) Steam generator surveillance by a complex monitoring system.** Mauersberger, H.; Pridoehl, E.; Froehlich, K.J.; Matal, O.; Banovec, J.; Sirek, J. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic; Vyzkumny Ustav Energetickych Zarizeni, Brno, Czechoslovakia). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Methods of leak detection are studied within the development of a complex diagnostic system for sodium-fired steam generators. It is stated that none of the methods is optimal such as to cover all conditions of the steam generator operation. Therefore, a system of several monitors is proposed operating with various methods, such as chemical methods based on the indication of hydrogen in sodium and in the cover gas, an acoustic method, with the detection of bubbles using flow ratemeters, and the measurement of absolute pressure in the sodium buffer tank. All monitors are connected to a central microcomputer. The benefits and constraints of the methods are briefly discussed. (Z.M.) 2 figs., 10 refs.

11469 **(KFK—4249) Water simulation experiments on the instantaneous source term of a severe breeder reactor accident.** Schuetz, W.; Minges, J.; Haenscheid, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Sep 1987. 102p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88751938/JAW.

FAUST is an experimental program to give contributions to the assessment of the instantaneous source term in case of an LMFBR loss-of-flow accident with expanding fuel or sodium vapor. In the FAUST 1a-series, experiments with discharge of a gas-particle mixture (nitrogen from 0.3 to 2.0 MPa with iron or nickel powder of different particle size) from a 1.45 liter source into a water pool cylinder of 28.8 cm diameter and 1 m height by rupture disks were performed at different pool height (0.90 cm). The system was closed, i.e. no openings were provided in the cover plate. Important measuring instruments were high-speed cameras, pressure transducers and magnets for article trapping in the cover gas. The most important quantity to be determined was the retention factor RF, defined as the ratio of the amount of particles discharged to the amount trapped in the cover gas. Furthermore, the expansion characteristics of the bubble, the correlated cover gas phenomena, the oscillation period and the entrainment were considered. In most cases, particle release stayed below detection limit, which corresponds to RF $>$ 10/sup 4/. For the 1B series, using the same source, a larger pool vessel (63 cm diameter, 60 cm height) was installed and a cover plate with two openings of 4 cm diameter to simulate leaks. The discharge pressure was varied from 0.002 to 4 MPa. Other experimental parameters were pool height (0.50 cm), particles size (1 to 100 μm), and leak size. A release of airborne particles was found only at very low discharge pressure. At high pressure, major amounts of water were released, whereas the release of particles remained below detection limit (retention factor $>$ 10/sup 4/). The oscillation period was of the order of 80 msec for 1A and 50 msec for 1B. Approximative calculations have shown that the large particle absorption may be explained by impaction during the bubble oscillations.

11470 **Performance of breached LMFBR fuel pins during continued operation.** Lambert, J.D.B.; Strain, R.V.; Gross, K.C.; Hofman, G.L.; Colburn, R.P.; Adamson, M.G.; Ukai, S. (Argonne National Lab., IL, USA; Westinghouse Hanford Co., Richland, WA, USA; General Electric Co., Sunnyvale, CA, USA; Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan). pp vp of Nuclear fuel performance. Volume 1 of 2 . London, England; British Nuclear Energy Society (1985). (CONF-850398—).

From British Nuclear Energy Society nuclear fuel performance meeting; Stratford-upon-Avon, UK (25 Mar 1985).

Four EBR-II tests were used to scope the behaviour of breached mixed-oxide pins. After release of stored fission gas, delayed-neutron signals were large and easily detected, although not readily correlated with exposed fuel area. No problems were met during reactor operation or fuel handling. Fuel-sodium reaction caused only narrow breaches which released minute amounts of fuel and fission products; the reaction product appeared dense and non-friable. These initial results indicated LMFBR oxide pins could have considerably potential for operating in the breached mode.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

11471 **(CONF-870804—47) Encapsulated sink-side thermal energy storage for pulsed space power systems.** Foote, J.P.; Morris, D.G.; Olszewski, M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003917/JAW.

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

In sprint mode space applications, which require high power for relatively short durations, energy storage devices may be employed to reduce the size and mass of the thermal management

system. This is accomplished by placing the reject heat in the thermal store during the sprint mode. During the remaining nonoperational portion of the orbit the stored heat is dissipated to space. The heat rejection rate is thus reduced, and this results in a smaller radiator being required. Lithium hydride (LiH) has been identfied as the best candidate for use in power system sink-side thermal energy storage applications due to its superior heat storage properties and suitable melt temperature (T/sub m/ = 962K). To maximize storage density, both sensible and latent modes of heat storage are used. This paper focuses on the use of encapsulated lithium hydride shapes in a packed bed storage unit with lithium or NaK as the heat transport fluid. Analytical and experimental development work associated with the concept is described. Since the program is in its early stages, emphasis thus far has been on feasibility issues associated with encapsulating lithium hydride spheres. These issues include shell stress induced by phase-change during heating, hydrogen diffusion through the encapsulating shell, heat transfer limitations due to poor conductivity of the salt, void behavior, and material constraints. The impact of these issues on the design of encapsulated lithium hydride spheres has been evaluated, and design alternatives have been identified for circumventing key problem areas.

11472 **(CONF-880122—1) Value-assessment of energy storage concepts in burst power systems.** Siman-Tov, M.; Olszewski, M.; Klett, D.E. (Oak Ridge National Lab., TN (USA); North Carolina Agricultural and Technical State Univ., Greensboro (USA)). 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87013756/JAW.

From 5. symposium on space nuclear power systems; Albuquerque, NM, USA (11 Jan 1988).

Due to the pulsed nature of burst power demands, energy storage can be considered to effect reductions in overall system mass and reduce the area requirements for radiators. Incorporation of energy storage allows subsystems (i.e., radiator, energy conversion cycle) to be sized for orbital average duty. Without storage these systems must be sized to meet peak demands. Storage technologies include thermal (TES) and regenerable electrical energy (RES) storage. Technologies targeted for RES include flywheels, fuel cells and batteries.

11473 (N—88-10829, pp vp) **Transient modeling of the thermohydraulic behavior of high temperature heat pipes for space reactor applications.** Hall, M.L.; Doster, J.M. 1986. NTIS, PC A19/MF A01. (NASA-CP—2446; REPT—86B0561; NAS—1.55:2446; CONF-861182—).

From 14. space simulation conference; Baltimore, MD, USA (3 Nov 1986).

Many proposed space reactor designs employ heat pipes as a means of conveying heat. Previous researchers have been concerned with steady state operation, but the transient operation is of interest in space reactor applications due to the necessity of remote startup and shutdown. A model is being developed to study the dynamic behavior of high temperature heat pipes during startup, shutdown and normal operation under space environments. Model development and preliminary results for a hypothetical design of the system are presented.

11474 **Nuclear power in the future of space exploration.** Boudreau, J.E. pp 157-169 of Human quest in space; Proceedings of the Twenty-fourth Goddard Memorial Symposium, Greenbelt, MD, Mar. 20, 21, 1986. Burdett, G.L.; Soffen, G.A. San Diego, CA; Univelt, Inc. (1987). (CONF-8603226—).

From 24. Goddard memorial symposium on the human quest in space; Greenbelt, MD, USA (20 Mar 1986).

Several different types of nuclear power systems are examined. The design and capabilities of radioisotope thermoelectric generators, dynamic isotope power systems, and reactors applicable for power requirements in the range of hundreds of watts to thousands of megawatts are discussed. The three phases of the nuclear power program, SP100, aimed at developing a power system to operate in the 50-500-kW range, are described. It is argued that this reactor is necessary to meet the power requirements for such activities as materials processing in space and missions to Mars. Diagrams of the proposed reactor are presented.

11475 **Multimegawatt nuclear systems for space power.** Dearien, J.A.; Whitbeck, J.F. pp 468-477 of IECEC '87; Proceedings of the Twenty-second Intersociety Energy Conversion Engineering Conference, Philadelphia, PA, Aug. 10-14, 1987. Volumes 1, 2, 3, & 4. New York, NY; American Institute of Aeronautics and Astronautics (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

The conceptual design and performance capability requirements of multi-MW nuclear powerplants for SDI systems are considered. The candidate powerplant configurations encompass Rankine, Brayton, and thermionic cycles; these respectively provide the lightest to heaviest system masses, since reactor and shield masses represent only 10-30 percent of total closed power system weight for the Rankine and Brayton systems. Many of the gas reactor concepts entertained may be operated in dual mode, thereby furnishing both long term low power and high power for short periods. Heat rejection is identified as the most important technology, since about 50 percent of the total closed mass is constituted by the heat rejection system. 9 references.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 11517, 11542, 11575

11476 **(NUREG—0936-Vol.6-No.3) NRC Regulatory Agenda: Quarterly report, July-September 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Rules and Records). Nov 1987. 121p. NTIS, PC A06/MF A01 - GPO. Order Number TI88900216/JAW.

The NRC Regulatory agenda is a compilation of all rules on which the NRC has proposed or is considering action and all petitions for rulemaking which have been received by the commission and are pending disposition by the commission. The regulatory agenda is updated and issued each quarter.

11477 **(NUREG/CR—2000-Vol.6-No.11) Licensee Event Report (LER) compilation: For month of November 1987.** (Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 82p. (ORNL-NSIC—200-Vol.6-No.11). NTIS, PC A05/MF A01 - GPO. Order Number TI88004323/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

11478 **(NUREG/CR—5033) Summary description of the scale modular code system.** Parks, C.V. (Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 131p. (ORNL/CSD/TM—252). NTIS, PC A07/MF A01 - GPO. Order Number TI88004582/JAW.

SCALE - a modular code system for Standardized Computer Analyses for Licensing Evaluation - has been developed at Oak Ridge National Laboratory at the request of the US Nuclear Regulatory Commission staff. The SCALE system utilizes well-established computer codes and methods within standard analytic sequences that allow simplified free-form input, automate the data processing and coupling between codes, and provide accurate and reliable results. System development has been directed at criticality safety, shielding, and heat transfer analysis of spent fuel transport and/or storage casks. However, only a few of the sequences (and none of the individual functional modules) are restricted to cask ap-

plications. This report will provide a background on the history of the SCALE development and review the components and their function within the system. The available data libraries are also discussed, together with the automated features that standardize the data processing and systems analysis. 83 refs., 32 figs., 11 tabs.

2108 Economics

11479 **Parametric economic studies for inertial confinement fusion electric power plants.** Meier, W.R.; Hogan, W.J. (Lawrence Livermore National Lab., Livermore, CA). pp 152-157 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract W-7405-ENG-48.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

The authors conducted parametric economic studies for inertial confinement fusion (ICF) electric power using an economic model to estimate the cost of electricity. They found that the economy of scale of the reactor is an important factor in determining the combination of target gain, driver efficiency, and electric conversion efficiency required for an economically competitive system. A strong economy of scale allows a significant reduction in these performance parameters for a given cost of electricity. The degree of reduction is dependent, however, on the maximum achievable chamber pulse rate.

11480 **Emerging nuclear energy systems: Economic challenge.** Nuckolls, J.H. (Univ. of California, Lawrence Livermore National Lab., Livermore, CA). pp 3-12 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract W-7405-ENG-48.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

Future nuclear energy systems may achieve substantially lower energy costs than those of existing fossil energy systems and comparable capital costs. Such low cost nuclear energy would provide a strong economic incentive to minimize the use of fossil fuels. If these low cost nuclear energy systems emerge in the next few decades, 21st century civilization may be able to avert potentially disastrous CO/sub 2/ induced global climate changes.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

11481 **(EIR—633) Displaced spectra techniques as a tool for peak identification in PSD-analysis.** Pineyro, J.; Behringer, K. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Oct 1987. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700790/JAW.

Sharp peaks in the power spectral density function can be due to periodic components in the noise signal or due to narrowband random contributions. A novel method based on Fourier transform techniques is presented which allows under certain limitations to identify the peak type.

11482 (INIS-mf—11077, pp 57-69) **Boiling noise detection experiment with in-core detectors in a critical assembly.** Aguilar, O.; Por, G. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

An experiment was performed on the critical assembly of the Central Research Institute for Physics in Budapest, Hungary, to test a mathematical model of boiling detection using the noise method. A test section, which is described in detail, was placed in the reactor core. The boiling conditions were modelled in a glass tube, the temperature course was detected using thermocouples. Bubbles were checked visually. Neutron characteristics were determined with a number of neutron detectors placed at different heights and on different radii of the core. The measured values were recorded on magnetic tape. They were evaluated using a PDP computer linked to a CAMAC system. The most important results of the experiment are shown graphically. They are in good agreement with calculations based on the test mode. (Z.M.) 10 figs., 1 tab., 8 refs.

11483 (INIS-mf—11077, pp 142-153) **Damped resonances in the neutron power spectra in coupled multivariable reactor dynamical models.** Mesko, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Determining instabilities in reactor behavior is possible from the knowledge of spectra measured under steady state operating conditions. Damped resonances in PSD spectra need not necessarily be always associated with external noise sources but they may be due to covert internal feedback processes. The problems are discussed of the effect of variables on the resonances in a point model of reactor dynamics. The system variables in the model consist of neutron density, delayed neutron density, fuel and coolant temperature, and the contribution of voids for the event of subcooled boiling. (Z.M.) 5 figs.

11484 **(INIS-mf—11077) 18th informal meeting on reactor noise.** Dach, K. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1986. 288p. (In English and French). (CONF-8504220—). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW.

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The proceedings contain the texts of 24 papers all of which fall under the INIS Subject Scope. The main purpose of the meeting of more than 90 scientists and specialists from 18 countries was for them to get acquainted with the current state and prospective development of noise diagnostics application in nuclear reactor operation. (Z.M.).

11485 **(UJV—7839-R) Effective method of solving the multigroup diffusion problem in hexagonal geometry. Part I. Theory.** Kujal, B. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Jan 1987. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700829/JAW.

An effective method of solving two-dimensional multigroup diffusion equations in hexagonal geometry is described. The method is based on the following two ideas: nodal approach, and expansion of one-dimensional neutron fluxes inside the node into polynomials up to the third order. The resulting relations for the interface-averaged partial currents, node-averaged fluxes and flux moments are used in computer code NEHEX. The code was found to be an accurate and effective computational tool. Its description and validation against reference benchmark problems will be published as Part II of this report. (author) 1 fig., 1 tab., 9 refs.

11486 **The ultimate safe (U.S.) reactor - A concept for the third millenium.** Gat, U. (Oak Ridge National Lab., (ORNL) Oak Ridge, TN 37831). pp 287-290 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract AC05-84OR21400.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

The Ultimate Safe (U.S.) Reactor is based on a novel safety concept. Fission products in the reactor are allowed to accumulate only to a level at which they would constitute a harmless source term. Removal of fission products also removes the decay heat - the driving force for the source term. The reactor has no excess criticality and is controlled by the reactivity temperature coefficient. Safety is inherent and passive. Waste is removed from the site promptly.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 11478, 11544

11487 **(CONF-880218—3) An object-oriented simulation package for power plants.** Robinson, J.T.; Otaduy, P.J. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02. Order Number DE88000950/JAW.

From Society for Computer Simulation multiconference; San Diego, CA, USA (3 Feb 1988).

This paper describes the application of object-oriented programming to the simulation of continuous/discrete processes such as nuclear power plants. Systems are modeled using this technique as a collection of objects that communicate by passing messages, which invoke methods that describe the state and dynamic behavior of objects. The objects themselves generally correspond to actual plant components, thus minimizing the representational mismatch between actual and modeled systems and facilitating their validation. Several concepts of object-oriented programming, in particular classes, inheritance, and message passing, have proved to be very useful for simulation. The use of these features are discussed and illustrated with examples.

11488 **(EPRI-CS—5481) Guide for the use of corrosion-resistant coatings on steam turbine blades: Final report.** (Southern California Edison Co., Westminster (USA). Shop Services and Instrumentation Div.). Nov 1987. 84p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920099/JAW.

The purpose of this "User's Guide" is to facilitate the understanding and use of coatings on low pressure turbine blades in order to reduce corrosion and degradation, and consequently to increase steam turbine service life. This information is intended to assist utilities and Users of steam turbines to select, implement, install, identify, inspect, and repair coated blading. The Introduction Section includes philosophies on the needs for corrosion protection and the benefits of coating use. This section also mentions areas of coating related concerns which need to be evaluated by the User to develop a successful coating program. The Background Section explains the need for turbine-related corrosion protection and notes the reasons why the use of thin coatings represents one desirable approach. This section also contains some results which Southern California Edison (SCE) has experienced with coated blades and helps to place the turbine coating option in perspective with alternatives. The Use of Recommended Coatings Section provides the User with information on each of the recommended coatings and addresses factors whcih may aid the User in selecting the coating most beneficial to the User's specific needs. Lastly, the Appendices contain specifications for individual coatings and a procedure developed by Southern California Edison Company to mark coated turbine parts. 8 refs., 18 figs.

11489 **(INIS-mf—11077, pp 70-73) Evaluation of coolant level height by dynamic behaviour of core barrel.** Dach, K.; Kuzelka, V. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia; Statni Vyzkumny Ustav pro Stavbu Stroju, Bechovice, Czechoslovakia). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Briefly described is the mathematical model underlying the diagnostics of dynamic behavior of the reactor core barrel. The barrel is considered to be a cylindrical jacket surrounded by water from outside and inside. A relation is derived for the determination of the barrel frequency spectrum in dependence on eigenfrequency and the barrel size at various effects of the surrounding liquid, including its density and level height. It is stated that the diagnostics of core barrel motion is considered as a process of identifying disturbances in the dynamic behavior, based on the interpretation of noise signals. The instrumentation for this purpose consists of sensors, preamplifiers, amplifiers and signal processing blocks applied in the in-service reactor diagnostics system. (Z.M.).

11490 (INIS-mf—11077, pp 251-267) **On-line surveillance system by Merlin Gerin.** Indjirdjian, J.; Vullierme, C. (Etablissements Merlin et Gerin, 38 - Grenoble, France). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

Automated diagnostic system SES was developed for French 1300 MW pressurized water reactors. The system primarily fulfils the functions of monitoring primary circuit component leaks, loose parts and vibrations inside the reactor core. The core of the system is a PDP 11/23 computer to which up to 15 stellite units can be connected. Further development of the SES system is focused on the extension of diagnostic possibilities by the detection of fuel cladding damage and by the monitoring of primary coolant flow and of the vibrations of main circulation pumps. Artificial intelligence elements will be incorporated in the existing system and it will also be possible to adapt the whole system to BWR's and fast reactors. (Z.M.) 10 figs.

11491 (INIS-mf—11077, pp 268-284) **Project of an online information system for monitoring and diagnosing neutron and acoustic fluctuations in fast reactors. Use of artificial intelligence in the design of a detection and diagnostic system based on noise analysis.** Le Guillou, G.; Malvache, P.; Himbaut, S.; Pham, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance, France). 1986. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The objective of the project is the development of an information system for on-line surveillance and primary diagnostics of a fast reactor nuclear power plant, this on the bais of neutron and acoustic noise. The system will be modular and will use real time signal processing methods and pattern recognition methods. The basic steps are described of both stages and implementation criteria are listed. The entire project is scheduled for 3 years and should be finished in 1986. (A.K.) 3 figs.

11492 **(NUREG/CR—4939-Vol.1) Improving motor reliability in nuclear power plants: Volume 1, Performance evaluation and maintenance practices.** Subudhi, M.; Gunther, W.E.; Taylor, J.H.; Sugarman, A.C.; Sheets, M.W. (Brookhaven National Lab., Upton, NY (USA); Nutech Engineers, Inc., San Jose, CA (USA)). Nov 1987. Contract AC02-76CH00016. 152p. (BNL-NUREG—52031-Vol.1). NTIS, PC A08/MF A01 - GPO. Order Number TI88003913/JAW.

This report constitutes the first of the three volumes under this NUREG. The report presents recommendations for developing a cost-effective program for performance evaluation and maintenance of electric motors in nuclear power plants. These recommendations are based on current industry practices, available techniques for monitoring degradation in motor components, manufacturer's recommendations, operating experience, and results from two laboratory tests on aged motors. Two laboratory test reports on a small and a large motor are presented in separate volumes of this NUREG. These provide the basis for the various functional indicators recommended for maintenance programs in this report. The overall preventive maintenance program is separated into two broad areas of activity aimed at mitigating the potential effects of equipment aging: Performance Evaluation and Equipment Maintenance. The latter involves actually maintaining the condition of the equipment while the former involves those activities undertaken to monitor degradation due to aging. These monitoring methods are further categorized into periodic testing, surveillance testing, continuous monitoring and inspections. This study focuses on the methods and procedures for performing the above activities to maintain the motors operationally ready in a nuclear facility. This includes an assessment of various functional indicators to determine their suitability for trending to monitor motor component condition. The intrusiveness of test methods and the present state-of-the-art for using the test equipment in a plant environment are discussed. In conclusion, implementation of the information provided in this

report, will improve motor reliability in nuclear power plants. The study indicates the kinds of tests to conduct, how and when to conduct them, and to which motors the tests should be applied. 44 refs., 12 figs., 13 tabs.

11493 **(NUREG/CR—4939-Vol.2) Improving motor reliability in nuclear power plants: Volume 2, Functional indicator tests on a small electric motor subjected to accelerated aging.** Subudhi, M.; Taylor, J.H.; Lofaro, R.; Sugarman, A.C.; Sheets, M.W.; Skreiner, K.M. (Brookhaven National Lab., Upton, NY (USA); Nutech Engineers, Inc., San Jose, CA (USA)). Nov 1987. Contract AC02-76CH00016. 75p. (BNL-NUREG—52031-Vol.2). NTIS, PC A04/MF A01 - GPO. Order Number TI88004072/JAW.

A ten horsepower electric motor was artificially aged by plug reverse cycling for test purposes. The motor was manufactured in 1967 and was in service at a commercial nuclear power plant for twelve years. Various tests were performed on the motor throughout the aging process. The motor failed after 3.79 million reversals (3 seconds per reversal) over seven months of testing. Each test parameter was trended to assess its suitability in monitoring aging and service wear degradation in motors. Results and conclusions are discussed relative to the applicability of the tests performed to nuclear power plant motor maintenance programs. 15 refs., 28 figs., 1 tab.

11494 **(NUREG/CR—4939-Vol.3) Improving motor reliability in nuclear power plants: Volume 3, Failure analysis and diagnostic tests on a naturally aged large electric motor.** Subudhi, M.; Taylor, J.H.; Sheets, M.W. (Brookhaven National Lab., Upton, NY (USA); Nutech Engineers, Inc., San Jose, CA (USA)). Nov 1987. Contract AC02-76CH00016. 44p. (BNL-NUREG—52031-Vol.3). NTIS, PC A03/MF A01 - GPO. Order Number TI88003912/JAW.

Stator coils of a naturally failed 400 hp motor from the Brookhaven National Laboratory test reactor facility were tested for their dielectric integrities. The motor was used to drive the primary reactor coolant pump for the last 20 years. Maintenance activities on this motor during its entire service life were minimal, with the exception of meggering it periodically. The stator consisted of ninety individual coils which were separated for testing. Seven different dielectric tests were performed on the coils. Each set of data from the tested coils indicated a spectrum of variation depending on their aging conditions and characteristics. By comparing the test data to baseline data, the test methods were assessed for application to motor maintenance programs in nuclear power plants. Also included in this study are results of an investigation to determine the cause of this motor failure. Recommendations are provided on the aged condition of a second identical primary pump motor which is the same age and presently in operation. Recommendations are also presented relating to each of the dielectric test methods applicability to motor maintenance programs. 6 refs., 11 figs., 5 tabs.

11495 **(NUREG/CR—4969) Axisymmetric analysis of a 1:6-scale reinforced concrete containment building using a distributed cracking model for the concrete.** Weatherby, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1987. Contract AC04-76DP00789. 78p. (SAND—87-1670). NTIS, PC A05/MF A01 - GPO. Order Number TI88003814/JAW.

Results of axisymmetric structural analyses of a 1:6 scale model of a reinforced concrete nuclear containment building are presented. Both a finite element shell analysis and a simplified membrane analysis were made to predict the structural response and ultimate pressure capacity of the model. Analytical results indicate that the model will fail at an internal pressure of 187 psig when the stress level in the hoop reinforcement at the midsection of the cylinder exceeds the ultimate strength of the bar splices. 5 refs., 34 figs., 6 tabs.

11496 **(NUREG/CR—4987) Simulated seismic tests on 1/42- and 1/14-scale category 1, auxiliary building.** Bennett, J.G.; Dove, R.C.; Dunwoody, W.E.; Endebrock, E.; Farrar, C.; Goldman, P. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract W-7405-ENG-36. 44p. (LA—11093-MS). NTIS, PC A03/MF A01 - GPO. Order Number TI88002743/JAW.

Two scale-model structures representing an idealized auxiliary building were seismically tested. The scales (1/42, 1/14) were chosen so that both structures were models of the prototype, and the 1/42-scale model was a 1/3-scale model of the 1/14-scale structure. Both models were constructed out of microconcrete. The 1/42-scale used wire mesh to simulate reinforcing, and the 1/14-scale used model deformed bars. The general result verified previous test experience in this program: the frequency response of these structures, when subjected to seismic design loads, will be below that predicted for the structure using conventional analysis methods. This implies the frequency content and magnitude of floor response spectra, in general, will not be as predicted from the structural analysis. The implication of this result for equipment and piping is under investigation. The recommendation of this program, based on testing thus far, is to verify the conclusions on larger real concrete structures of a geometry that will be agreed upon by the technical review group for this program. 5 refs., 17 figs., 7 tabs.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 11457, 11486

11497 **High performance fuel element with end seal.** Lee, G.E.; Zogg, G.J. (to Dept. of Energy, Washington, DC). US Patent 4,704,248. 3 Nov 1987. Filed date 18 Dec 1984. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a pair of generally vertically stacked prismatic fuel elements disposed in a nuclear reactor, each of the elements is substantially identical and comprises: a block of refractory material, such as graphite, having substantially parallel spaced first and second end surfaces, the first end surface having a peripheral sealing flange formed thereon extending away from the second surface, and the second end surface having a peripheral sealing recess sized to receive the flange, the block having longitudinal first coolant passages therethrough disposed inwardly of the flange and the recess coolant, the block further including peripheral longitudinal second coolant passages extending intermediate the end surface and in general alignment with the flange and recess. Each of the second coolant passages has a first end and a second end with each end of the second coolant passages being blocked, the block further comprises two bypasses for each of the second passages, one bypass intersecting the second passage adjacent but spaced from the first end surface and intersecting a first passage, and the other bypass intersecting the second passage adjacent but spaced from the second end surface and intersecting a first passage. The extent of the flange is greater than the depth of the recess so that a plenum is defined by facing first and second end surfaces, the plenum is uninterrupted within the flange of the first end surface defining the plenum.

2204 Control Systems

REFER ALSO TO CITATION(S) 11522

11498 **(CONF-880218—2) Knowledge-enhanced network simulation modeling of the nuclear power plant operator.** Schryver, J.C.; Palko, L.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number DE88000344/JAW.

From Society for Computer Simulation multiconference; San Diego, CA, USA (3 Feb 1988).

Simulation models of the human operator of advanced control systems must provide an adequate account of the cognitive processes required to control these systems. The Integrated Reactor Operator/System (INTEROPS) prototype model was developed at Oak Ridge National Laboratory (ORNL) to demonstrate the feasi-

bility of dynamically integrating a cognitive operator model and a continuous plant process model (ARIES-P) to provide predictions of the total response of a nuclear power plant during upset/emergency conditions. The model consists of a SAINT network of cognitive tasks enhanced with expertise provided by a knowledge-based fault diagnosis model. The INTEROPS prototype has been implemented in both closed and open loop modes. The prototype model is shown to be cognitively relevant by accounting for cognitive tunneling, confirmation bias, evidence chunking, intentional error, and forgetting.

11499 **(CONF-8709189—4) Evaluation of differential shim rod worth measurements in the Oak Ridge Research Reactor.** Bretscher, M.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003022/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

Reasonable agreement between calculated and measured differential shim rod worths in the Oak Ridge Research Reactor (ORR) has been achieved by taking into account the combined effects of negative reactivity contributions from changing fuel-moderator temperatures and of delayed photoneutrons. A method has been developed for extracting the asymptotic period from the shape of the initial portion of the measured time-dependent neutron flux profile following a positive reactivity insertion. In this region of the curve temperature-related reactivity feedback effects are negligibly small. Results obtained by applying this technique to differential shim rod worth measurements made in a wide variety of ORR cores are presented.

11500 **(EPRI-NP—5524) Testing and installation of a BWR digital feedwater control system: Final report.** Popovic, J.R.; Hammer, M.F.; Sun, B.K.H.; Divakaruni, S.M. (Atomic Energy of Canada Ltd., Mississauga, Ontario; Northern States Power Co., Monticello, MN (USA); Science Applications International Corp., Huntsville, AL (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1987. 224p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920106/JAW.

This reprt describes the design testing and commissioning process for the Digital Feedwater Control System (DFSC) at the Monticello BWR Nuclear Generating plant in Minnesota owned by the Northern States Power Company. The microprocessor based controller replaced the analog controller in the feedwater control loop to improve performance, reliability of control and ease of maintenance. The DFSC has demonstrated reliable operation since its installation in July 1986 and examples of its operation are given in the report. This report may provide other utilities with useful information about this digital feedwater control system implementation, its testing, installation and operation. 13 refs., 21 figs., 5 tabs.

11501 **(INIS-mf—10766) Practical application of plant operating experience in staff indoctrination and training programs.** Schabert, P.M. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 29p. (In German). (CONF-871067—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751290/JAW.

From Meeting of the Society for Reactor Safety; Cologne, F.R. Germany (29 Oct 1987).

The body of individuals directly involved in the practical application of plant operating experience consists primarily of members of the following groups: plant management, chief standby contingency, section and subsection managers, shift supervisors, other personnel, personnel training subsection. A number of means are implemented for transmission of operating experience data to relevant parties in a form appropriate in nature and purpose to the respective recipient. These include: daily morning meetings, department meetings, regularly scheduled discussions, shift superintendent meetings, initial indoctrination, refresher training, simulator training. Dissemination of operating experience via the above-mentioned organizational units and channels ensures that operating experience is not merely 'acquired', but is instead passed on to selected recipients for practical application.

11502 (IWGFPT—26, pp 127-134) **Evaluation of the cladding integrity on the basis of the radiation distribution in primary circuit of PWRs.** Barta, O.; Bena, J.; Kapisovsky, V.; Smiesko, I. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia; Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice, Czechoslovakia; Atomova Elektraren Bohunice, Jaslovske Bohunice, Czechoslovakia). May 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE87900925/JAW. (CONF-861045—).

From IAEA technical committee meeting on the safe handling of tritium; Vienna, Austria (13 Oct 1986).

A part of the software package of an autonomous gamma spectrometry monitor of the primary coolant is described. Computer code enables, on the basis of the analysis of the radiation distribution in the primary coolant at steady-state conditions, which has been measured by in-line gamma spectrometry monitor, to estimate the total number of defective fuel rods and their deterioration. The comparison of the DFE-code's results to sipping test results after a fuel cycle of the 1st unit of the V1 power station is presented. 12 references, 8 figures, 4 tables.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 11523, 11551, 11552, 11553, 11559, 11560, 11560, 11566, 11568, 11569, 11573, 11579, 12492, 12576, 12577, 12600, 12600, 12660, 12681, 12682, 12711, 13866

11503 **(DOE/SSDP—0018) Shippingport Station Decommissioning Project: FYs 1984-1985 annual progress report, October 1, 1983 through September 30, 1985.** (Westinghouse Hanford Co., Shippingport, PA (USA)). 29 May 1987. Contract AC06-84RL10421;AC06-76RL01857. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003991/JAW.

This report presents progress on the Shippingport Station Decommissioning Project for FYs 1984-85. There are three main topics: project management, decommissioning project activities, and issues of concern. The project purpose is demonstration of nuclear plant decommissioning and dismantlement operations in an environment of current industry practices. 8 refs., 8 figs., 2 tabs.

11504 **(DOE/SSDP—0019) Shippingport Station Decommissioning Project: FY 1986 annual progress report, October 1, 1985 through September 30, 1986.** (Westinghouse Hanford Co., Shippingport, PA (USA)). 29 Jan 1987. Contract AC06-76RL01857;AC06-84RL10421. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004009/JAW.

This report presents progress on the Shippingport Station Decommissioning Project for FY 1986. There are two main topics: Project Management and Decommissioning Project Activities. Changes from technical and managerial concepts developed in the original Decommissioning Plan are presented with the related technical, economic, or schedule considerations. 9 refs., 4 figs., 3 tabs.

11505 **(NUREG/CR—5028) On the melting and refreezing of porous media.** Dosanjh, S.S. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 77p. (SAND—87-1976). NTIS, PC A05/MF A01 - GPO. Order Number TI88004259/JAW.

A model of melt formation and relocation in a one-dimensional core rubble bed is presented in this report. The analysis includes: mass conservation equations for the species of interest (UO_2 and ZrO_2); a momentum equation that represents a balance among drag, capillary and gravity forces; and an energy equation that incorporates the effects of convection by the melt, radiation and conduction through the bed, and the energy release associated with fission product decay. An equilibrium UO_2-ZrO_2 phase diagram is prescribed and radiative heat transfer through the bed is incorporated utilizing a temperature dependent thermal conductivity. A parametric study is conducted in which the height of the bed, the average particle diameter, the initial composition, the initial temperature profile, and aspects of the phase diagram are varied. Results from this study are then used to evaluate the DEBRIS module in the MELPROG computer code. Particular attention is given to the semiempirical melt relocation models in DEBRIS. Experiments

needed both to validate the current rubble bed model and to help guide future theoretical work are discussed. Three areas of uncertainty are addressed: (1) chemical interactions; (2) flow models; and (3) collapsing of a highly porous bed. 40 refs., 25 figs., 7 tabs.

11506 **(STUK-A—67) Monitoring of radioactivity in the environs of Finnish nuclear power stations in 1986. Supplement 12 to annual report STUK-A55.** Ilus, E.; Sjoeblom, K.L.; Aaltonen, H.; Klemola, S.; Arvela, H. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 82p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751321/JAW.

Results of the environmental programmes monitoring radioactivity around the Finnish nuclear power stations in 1986 are reported. After the end of April the fallout nuclides from the Chernobyl accident predominated in all samples taken from the environs of the two power stations Loviisa and Olkiluoto. Radionuclides originating from the Finnish power stations were detected mainly in samples taken from the aquatic environment. The concentrations of the locally discharged nuclides were very low in comparison with the fallout nuclides and their impact on the radiation doses of the population was insignificant. Both nuclear power stations are situated in the main fallout area in Finland. The results of these large monitoring programmes give a good picture of the behaviour of the Chernobyl fallout in the specific areas in Finland.

11507 **(ZJE—275) HERALD, a programme enumerating the radiation doses to the population following the release of radioactive gases and aerosols into the atmosphere after a nuclear reactor accident. Transport of the radioactive cloud to long distances up to thousands of kilometres.** Veverka, O. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1986. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88700831/JAW.

Program HERALD computes radiation doses to the population following an accident of a fission nuclear reactor, the destruction of the primary coolant circuit (LOCA), etc. The program was written with the intention to obtain a tool which would enable the user to follow numerically a radioactive cloud, its physical behaviour and its consequences up to extremely long distances of several thousands kilometres. Therefore the usual model of Gaussian distribution was avoided and the considerably simpler "box model" was chosen. This can be replaced by the "semi-box model". The fallout velocity of gases and particles is calculated using a simple model including the dependence on the Pasquillian stability class and on the local surface roughness. So is the scavenging coefficient for gases and particles, removed by either rainfalls, or snowfall or fogs. It is possible to employ corresponding empirical data. The program utilizes an ample data library holding nuclear data for approximately 500 fission products in 121 decay chains of at most 10 members, the corresponding dose factors for external gamma and beta irradiation from the cloud and the surface and from the inhaled and ingested radionuclides (ICRP-30). This library is now being extended to approximately 1,200 nuclides (products of activation, fission products and fuels including transuranium elements) for the purposes of normal operation and of heavy accidents. The program is written in standard language FORTRAN IV and is run on computer M 4030-1. (author) 5 figs., 34 tabs., 26 refs.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 10914, 11499, 11520, 12067

11508 **(ANL/RERTR/TM—11) The use of U_3Si_2 dispersed in aluminum in plate-type fuel elements for research and test reactors.** Snelgrove, J.L.; Domagala, R.F.; Hofman, G.L.; Wiencek, T.C.; Copeland, G.L.; Hobbs, R.W.; Senn, R.L. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). Oct 1987. Contract W-31109-ENG-38. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003714/JAW.

A high-density fuel based on U_3Si_2 dispersed in aluminum has been developed and tested for use in converting plate-type research and test reactors from the use of highly enriched uranium to the use of low-enriched uranium. Results of preirradiation testing and the irradiation and postirradiation examination of miniature fuel plates and full-sized fuel elements are summarized. Swelling of the U_3Si_2 fuel particles is a linear function of the fission density in the particle to well beyond the fission density achievable in low-enriched fuels. U_3Si_2 particle swelling rate is approximately the same as that of the commonly used UAl/sub x/ fuel particle. The presence of minor amounts of U_3Si or uranium solid solution in the fuel result in greater, but still acceptable, fuel swelling. Blister threshold temperatures are at least as high as those of currently used fuels. An exothermic reaction occurs near the aluminum melting temperature, but the measured energy releases were low enough not to substantially worsen the consequences of an accident. U_3Si_2-aluminum dispersion fuel with uranium densities up to at least 4.8 Mg/m^3 is a suitable LEU fuel for typical plate-type research and test reactors. 42 refs., 28 figs., 7 tabs.

11509 **(CONF-871101—74) Unirradiated characteristics of U-Si alloys as dispersed-phase fuels.** Domagala, R.F.; Wiencek, T.C. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003037/JAW.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Los Angeles, CA, USA (15 Nov 1987).

To satisfy the power demands of many research reactors, a new LEU fuel with a high density and U content was needed. Any fuel must be compatible with Al and its alloys so that it may be fabricable as a dispersed-phase in Al alloy and Al matrix plate-type elements following, as nearly as possible, established commercial manufacturing techniques. U-Si and U-Si-Al alloys at or near the composition of U_3Si were immediately attractive because of work documented by the Canadians. 8 refs., 2 figs.

11510 **(CONF-8709189—3) The RERTR [Reduced Enrichment Research and Test Reactor] Program: Progress and plans.** Travelli, A. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003020/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

The progress of the Reduced Enrichment Research and Test Reactor (RERTR) Program is described. After a brief summary of the results which the RERTR Program, in collaboration with its many international partners, had achieved by the end of 1986, the activities, results, and new developments which occurred in 1987 are reviewed. Irradiation of the second miniplate series, concentrating on U_3Si_2-Al and U_3Si-Al fuels, was completed and postirradiation examinations were performed on many of its miniplates. The whole-core ORR demonstration with U_3Si_2-Al fuel at 4.8 g U/cm^3 was completed at the end of March with excellent results and with 29 elements estimated to have reached at least 40% average burnup. Good progress was made in the area of LEU usage for the production of fission ^{99}Mo, and in the coordination of safety evaluations related to LEU conversions of US university reactors. Planned activities include testing and demonstrating advanced fuels intended to allow use of reduced enrichment uranium in very-high-performance reactors. Two candidate fuels are U_3Si-Al with 19.75% enrichment and U_3Si_2-Al with 45% enrichment. Demonstration of these fuels will include irradiation of full-size elements and, possibly, a full-core demonstration. Achievement of the final program goals is still projected for 1990. This progress could not have been possible without the close international cooperation which has existed from the beginning, and which is essential to the ultimate success of the RERTR Program.

11511 **(CONF-8709189—5) Status of the ORR whole-core LEU U_3Si_2-Al fuel demonstration.** Bretscher, M.M.; Cornella, R.J.; Snelgrove, J.L.; Hobbs, R.W. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003023/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

This paper summarizes the operating cores, the ^{235}U fuel element burnups, and the core physics measurements made in the ORR Whole-Core LEU Fuel Demonstration.

11512 (ORNL/TM—10579) ORNL contributions to the Advanced Neutron Source (ANS) Project for October 1986-March 1987. Selby, D.L.; Harrington, R.M.; Peretz, F.J. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003694/JAW.

The Advanced Neutron Source (ANS) Facility - formerly called the Center for Neutron Research - will provide the world's best facilities for the study of neutron scattering. The ANS high power density reactor will be fueled with uranium silicide and cooled, moderated, and reflected by D_2O. Peak neutron fluxes in the reflector are expected to be 5 to 10 x 10^{19} neutrons per square meter with a power level between 270 MW and 300 MW. This report describes the status of technical work at ORNL on the ANS Project during the first half of FY 1987. The scope of this report includes Research and Development Tasks; Safety Tasks; Conceptual Design Tasks; and Project Support. The last two areas were only initiated as separate activities during this reporting period. Technical highlights include a better understanding of the relationship among neutron flux, core power, and core volume; preconceptual design work on a cold source for use in a very high gamma and neutron flux environment; identification of the major applicable safety rules and guidelines; and establishment of initial functional objectives for the containment structure.

11513 Neutronic calculations for a new high flux reactor. Difilippo, F.C.; Worley, B.A.; Vondy, D.R. (Oak Ridge National Lab., TN, USA). *Radiation Effects*; 96: No. 1-4, 57-60(Mar 1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The Oak Ridge National Laboratory has begun the design of a new high flux reactor to be used for basic research, isotope production, and material irradiation. One of the principal goals of the design is the production of a thermal flux peak in the reflector larger than 5 x 10^{15}/cm^{2}sec. None of the existing steady sources of neutrons in the world produce such neutron flux. A theoretical analysis of the slowing-down and diffusion of neutrons produced by a spherical fission source immersed in a moderator shows that the flux per unit power is maximized by combining a very undermoderated core with a very low absorbing reflector. The theoretical model interrelates total power density and transport properties with the thermal flux allowing very inexpensive scoping calculations. Full scale and detailed calculations were made with a numerical model which uses the BOLD VENTURE code system. Calculations show that a highly enriched ^{235}U reactor with D_2O as moderator and reflector would produce the desired peak flux, and the reactor would have a reasonable core life.

11514 Revision and physical benchmarking of the fission neutron source at the JANUS reactor. Williamson, F.S.; Holmblad, G.L.; Marshall, I.R.; Bennett, E.F.; Yule, T.J. (Argonne National Lab., Argonne, IL 60439). pp 101 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract W-31-109-ENG-38.

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

In April 1984, the highly enriched uranium fission converter assembly of the JANUS reactor was removed to satisfy Nuclear Safeguards requirements. Immediately prior to removal, the authors performed comprehensive physical benchmarks, involving neutron spectrometry, microdosimeter spectrometry, kerma distribution, and depth dose distributions. A new low-enriched uranium fission converter assembly has been fabricated and installed. Identical benchmarks of the revised configuration are compared, and the implications for radiobiological experiments are discussed.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 12523

2209 Reactor Safety

REFER ALSO TO CITATION(S) 11054, 11469, 11478, 11486, 11631, 12517, 12711, 13866, 13894

11515 (AERE-R—12462) Observations on radioactivity from the Chernobyl accident. Cambray, R.S.; Cawse, P.A.; Garland, J.A.; Gibson, J.A.B.; Johnson, P.; Lewis, G.N.J.; Newton, D.; Salmon, L.; Wade, B.O. (UKAEA Harwell Lab. Environmental and Medical Science Div.; Department of the Environment, London (UK)). Feb 1987. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751461/JAW.

Published in Nuclear Energy, v. 26(2) p. 77, Apr 1987.

A preliminary study of radioactivity from the Chernobyl accident for the Department of the Environment was started in June 1986 which involved taking on an opportunistic basis, samples of air, rain, grass and soil in the UK. This study was integrated into a programme of other investigations funded by the Departments of Health and Social Security and of Energy including measurements on people, in air, deposition and soil overseas, on deposition to buildings and the derivation where possible of parameters of interest in accident assessment. This report is a comprehensive account of all these initial investigations and presented in fulfilment of the Preliminary Study under DoE contract PECD 7/9/359.

11516 (BMU—1986-143) Compilation of external hazards (EH) to an integral design requirement for nuclear facilities. Final report. Gassert, W. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Technischer Ueberwachungs-Verein Stuttgart e.V. (Germany, F.R.)). Jul 1985. 532p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, Germany, F.R.

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

The aim of the project SR 268 was, to find a collective load-function for external hazards (EH) to reduce the large number of analyses for the different hazards. The investigations were restricted to the design of components in a reactor building of the KONVOI-type. The present design practice and the resulting conservatism is examined. Collective EH-load-functions on the basis of floor-response-spectra for nine soil- and earthquake-classes are developed, covering the site conditions in the Federal Republic of Germany. With these EH-functions it is possible to replace the numerous analyses for the different external hazards by one single analysis for each component in the reactor building of an arbitrary site.

11517 (CONF-870850—1) Testing, licensing, and code requirements for seismic isolation systems (for nuclear power plants). Seidensticker, R.W. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002978/JAW.

From Seminar on extreme load design of future nuclear plant facilities; Paris, France (24 Aug 1987).

The use of seismic isolation as an earthquake hazard mitigation strategy for nuclear reactor power plants is rapidly receiving interest throughout the world. Seismic isolation has already been used on at least two French PWR plants, was to have been used for plants to be built in Iran, and is under serious consideration for advanced LMR plants (in the US, UK, France, and Japan). In addition, there is a growing use of seismic isolation throughout the world for other critical facilities such as hospitals, emergency facilities, buildings with very high-cost equipment (e.g., computers) and as a strategy to reduce loss of life and expensive equipment in earthquakes. Such a design approach is in complete contrast to the conventional seismic design strategy in which the structure and components are provided with sufficient strength and ductility to

resist the earthquake forces and to prevent structural collapses or failure. The use of seismic isolation for nuclear plants can, therefore, be expected to be a significant licensing issue. For isolation, the licensing process must shift away in large measure from the superstructure and concentrate on the behavior of the seismic isolation system. This paper is not intended to promote the advantages of seismic isolation system, but to explore in some detail those technical issues which must be satisfactorily addressed to achieve full licensability of the use of seismic isolation as a viable, attractive and economical alternative to current traditional design approaches. Special problems and topics associated with testing and codes and standards development are addressed. A positive program for approach or strategy to secure licensing is presented.

11518 **(CONF-8708191—1) Three dimensional contact/impact methodology.** Kulak, R.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002945/JAW.

From 9. SMIRT - post conference - seminar on impact; Lausanne, Switzerland (26 Aug 1987).

The simulation of three-dimensional interface mechanics between reactor components and structures during static contact or dynamic impact is necessary to realistically evaluate their structural integrity to off-normal loads. In our studies of postulated core energy release events, we have found that significant structure-structure interactions occur in some reactor vessel head closure designs and that fluid-structure interactions occur within the reactor vessel. Other examples in which three-dimensional interface mechanics play an important role are: (1) impact response of shipping casks containing spent fuel, (2) whipping pipe impact on reinforced concrete panels or pipe-to-pipe impact after a pipe break, (3) aircraft crash on secondary containment structures, (4) missiles generated by turbine failures or tornados, and (5) drops of heavy components due to lifting accidents. The above is a partial list of reactor safety problems that require adequate treatment of interface mechanics and are discussed in this paper.

11519 **(CONF-8709192—4) Trends vs. reactor size of passive reactivity shutdown and control performance.** Wade, D.C.; Fujita, E.K. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002939/JAW.

From Annual NEACRP meeting; Helsinki, Finland (14 Sep 1987).

For LMR concepts, the goal of passive reactivity shutdown has been approached in the US by designing the reactors for favorable relationships among the power, power/flow, and inlet temperature coefficients of reactivity, for high internal conversion ratio (yielding small burnup control swing), and for a primary pump coastdown time appropriately matched to the delayed neutron hold back of power decay upon negative reactivity input. The use of sodium bonded metallic fuel pins has facilitated the achievement of the massive shutdown design goals as a consequence of their high thermal conductivity and high effective heavy metal density. Alternately, core designs based on derated oxide pins may be able to achieve the passive shutdown features at the cost of larger core volume and increased initial fissile inventory. For LMR concepts, the passive decay heat removal goal of inherent safety has been approached in US designs by use of pool layouts, larger surface to volume ratio of the reactor vessel with natural draft air cooling of the vessel surface, elevations and redans which promote natural circulation through the core, and thermal mass of the pool contents sufficient to absorb that initial transient decay heat which exceeds the natural draft air cooling capacity. This paper describes current US "inherently safe" reactor design.

11520 **(CONF-8710111—13) Vibrational experiments at the HDR [Heissdampfreaktor]: SHAG results and planning for SHAM.** Kot, C.A.; Malcher, L.; Steinhilber, H. (Argonne National Lab., IL (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.); Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Darmstadt (Germany, F.R.). Inst. fuer Betriebsfestigkeit). 1987. Contract W-31109-ENG-38. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002881/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

As part of the second phase of vibrational/earthquake investigations at the HDR (Heissdampfreaktor) Test Facility in Kahl/Main, FRG, high-level shaker tests (SHAG) were performed during June and July 1986 using a coast-down shaker capable of generating 1000 tons of force. The purpose of these experiments was to investigate full-scale structural response, soil/structure interaction, and piping and equipment response under strong excitation conditions. While global safety considerations imposed load limitations, the HDR soil/structure system was nevertheless tested to incipient failure. The performance of pipe support systems in as many as seven different multiple support pipe hanger configurations, ranging from flexible to stiff systems, was evaluated in the tests. Data obtained in the tests are used to validate analysis methods. The vibrational/earthquake investigations at the HDR are continuing with the SHAM experiments, planned for the spring of 1988. In these experiments the VKL piping loop will be subjected to direct multiple-point excitation at extremely high levels. The objective is to investigate different pipe support configurations at extreme loading, to establish seismic margins for piping, and to investigate possible failure/plastification modes in an in situ piping system.

11521 **(EPRI-NP—5475) Identification and classification of technical specification problems: Final report.** Bizzak, D.J.; Stella, M.E.; Stukus, J.R. (IT-Delian Corp., Monroeville, PA (USA)). Dec 1987. 75p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920113/JAW.

This report describes a methodology for a systematic review of nuclear plant technical specifications problems. Operating personnel conducted a line-by-line examination of the LaSalle Station technical specifications creating a computerized database of problems, categorized as to their cause, effect, and recommendations for resolving the problems. Some 102 technical specifications problems were identified. Results indicated that the predominant type of problem was inappropriate limiting conditions for operation. The ECCS and containment systems had the largest number of problem technical specifications. The most significant effect was extension of outage lengths. It was estimated that risk-based evaluations would help to justify desirable changes in some 40% of the problems. Both the methodology and the LaSalle database are detailed in the report. 9 refs., 2 figs., 8 tabs.

11522 **(EPRI-NP—5510-SR) Proceedings: 1986 seminar on emergency response facilities and implementation of safety parameter display systems.** Divakaruni, S.M. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1987. 603p. (CONF-8605316—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920123/JAW.

From Seminar on emergency response facilities and implementation of safety parameter display systems; Boston, MA, USA (6 May 1986).

Separate abstracts were prepared for the individual papers in this report. (JDB)

11523 **(EPRI-NP—5522-M) LOMI [low oxidation-state transition metal ion] decontamination reagents and related preoxidation processes: Final report.** Swan, T.; Segal, M.G.; Williams, W.J.; Pick, M.E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Dec 1987. 75p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920110/JAW.

The development of the LOMI decontamination system is described covering aspects from the initial laboratory oxide dissolution studies through to the application on a full reactor primary circuit. Limited work on advanced LOMI reagents for the dissolution of chromium containing oxide is also described. The optimization of potassium-permanganate based pre-oxidation reagents for high chromium oxides is discussed, leading to the establishment of the dilute NP (nitric permanganate) and AP (alkaline permanganate) reagents for use in combination with LOMI and also the POD (PWR oxidative decontamination) system using NP and citrox reagents. An outline of the extensive materials compatibility studies required to clear the reagents for reactor use is given. Much of this

work has been conducted by organizations independent of the CEGB, e.g., United Kingdom Atomic Energy Authority, General Electric, Agesta Project. For such work overall conclusions only are presented. A wide range of materials corrosion work has been undertaken in the joint CEGB/EPRI studies and some more sensitive issues such as the corrosion of Stellite have been addressed in detail. Waste management techniques have been developed to minimize the volume of arisings. These involve both the optimization of reagent composition to avoid use of excess chemicals and also the development of ion exchange techniques for the direct treatment of pre-oxidation reagents and for the control of reagent pH. The kinetics of chromium leaching using ozone as a pre-oxidation reagent have been investigated in detail since this gives low waste arisings.

11524 **(FMI-RR—1986/2) Dispersion of radioactive releases following the Chernobyl nuclear power plant accident. Interim report.** Savolainen, A.L.; Hopeakoski, T.; Kilpinen, J.; Kukkonen, P.; Kulmala, A.; Valkama, I. (Finnish Meteorological Inst., Helsinki). 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751303/JAW.

An already-published report on the Chernobyl nuclear reactor accident (Interim report on fallout situation in Finland from April 26 to May 4 1986. STUK-B-VALO-44, May 1986) also contains a meteorological survey carried out by the Finnish Meteorological Institute. This report contains a new survey of the earliest phase, made with the help of facts about the accident and the best available weather observational material. The investigation has been extended to cover the period following the end of that in the previous report. The meteorological survey presented here covers the whole period from April 26 to May 18 1986.

11525 **(INIS-mf—10764) Use of maintenance informations for feedback of operating experiences.** Verstegen, C.; Lindauer, E. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 16p. (In German). (CONF-871067—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751288/JAW.

From Meeting of the Society for Reactor Safety; Cologne, F.R. Germany (29 Oct 1987).

With the number of operating years growing, the feedback of operating experiences is of increasing importance in maintaining and improving the high standards of safety as well as reliability of NPPs. The paper discusses the experiences which GRS has gained in carrying out several programmes for evaluation of operating experiences. It is demonstrated by examples that such evaluations allow for a concrete assessment of preventive maintenance measures and for the detection of comparatively weak points. Thus they provide informations to further optimize the operation. The informations, which are required to perform the evaluations, are identified. They are available in the plant documentation. Indications are given as to which improvements of the plant documentation are suitable to reduce the effort for systematic evaluations of operating experience.

11526 **(INIS-mf—10765) Safety reserves for mitigation of events.** Simon, M. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 19p. (In German). (CONF-871067—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751289/JAW.

From Meeting of the Society for Reactor Safety; Cologne, F.R. Germany (29 Oct 1987).

Concepts and measures for control or mitigation of consequences of events which were not considered in the design explicitly, are intensively researched and discussed at present. These are events which have an unexpected course, or events with loss of safety-related equipment. With respect to the successful control of such events the safety reserves of the different plants are of interest. The measures taken in case of need are well known as 'accident management'. In contrary to these hypothetical events, in the presentation the reserves in control of such events are described which actually happened in the plants. At first the basic types of events and the measures taken according to plant design are mentioned. Then four incidents are discussed pointing out the reserves which were used and those which were available altogether to cope with the incident. At last the further development in the technique of incident control is shown.

11527 **(INIS-mf—10768) Investigation of technical measures (interventions) for unforseen events with failure of the safety system.** Kersting, E. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 35p. (In German). (CONF-871067—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751292/JAW.

From Meeting of the Society for Reactor Safety; Cologne, F.R. Germany (29 Oct 1987).

The contribution describes for unforeseen events with failure of safety systems technical measures to prevent accident situations as well as aspects of their efficiency. The spectrum of the application of those measures and the boundary conditions for their performances will be initially discussed. Later, an assessment will be made on the feasibility and effectiveness of selected possibilities of interventions for both PWR and BWR. Detailed descriptions will be given about substitutional measures (bleed and feed) on the secondary and on the primary side. Investigations revealed, that the German LWR's posseas great safety potentials by flexible application of the existing systems for controlling of events exceeding the design basis.

11528 (Juel-Spez—335, pp 3-32) **Plant description, analysis of system and events.** Mertens, J. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The initial events considered were a long-term outage of the main coolant system, power failure, primary coolant circuit leakages, and steam generator heating tube, leakage. The relevant consequences are practically nothing but the remobilisation of fission products which have deposited at the primary coolant circuit surfaces during normal operation. The most frequent case was response of the primary coolant circuit pressure relief valve. Pressure drops in the primary coolant circuit may also be a consequence of steam generator heating tube failures causing an incident.

11529 (Juel-Spez—335, pp 33-60) **System reliability studies.** Mohr, H.G.; Mertens, J. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The paper includes the reliability assessment for the surface cooling system, the gas purification system, emergency power facility, off-gas filter system and sub-atmospheric pressure holding system, the steam generator relief and steam generator shutdown system, as well as pressure suppression within the primary coolant circuit and the confinement. Among the issues to be evaluated there are also: Non-availability of the primary coolant circuit upon start-up for after-heat removal. Event frequency and non-availability data are stated in tables.

11530 (Juel-Spez—335, pp 61-98) **Thermodynamics and component stress in the primary coolant circuit.** Breitbach, G.; Jahn, W.; Rehm, W. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The study of the primary coolant loop behaviour concentrates on the case of failure of circulator cut-off equipment following failure of the steam generator feeding line, as well as on the natural convection in the primary circuit under pressurized conditions, with the isolating valve of the circulator in 'open' position. Calculated or assessed data are presented relating to the temperature buildup in the support structures under incident conditions, to the strains affecting the area of close contact of the claws and the core cylinder, and to circulator system behaviour in case of failure of the steam generator feeding line and of the circulator cut-off system.

11531 (Juel-Spez—335, pp 99-130) **Steam generator leaks and the processes involved.** Wolters, J.; Finken, R.; Jahn, W.; Moormann, R. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The volume of steam ingress depends inter alia from the size of the leak. The design-basis accident is defined to be severence type break of a steam generator pipe with a leak size of double pipe section. This leak size and a smaller one is taken as the basis for assessment of pressure buildup in the primary circuit. In addition, pressure buildup through ingressing steam is calculated for the case of complete steam generator piping severence at the superheater side. This is equivalent to the case of the tubeplate connection cylinder being torn off, which has been chosen as a design-basis accident phenomenon in earlier HTR design concepts.

11532 (Juel-Spez—335, pp 131-159) **Release of fission products from the core of the HTR-modul.** Verfondern, K. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

Due to the fact that the fuel element temperature is low in the HTR-Modul, even maximum values in case of an incident, fission product release from the pebble-bed core is expected to be minimal also in case of failure of the forced circulation cooling system. Calculations are made using the FRESCO code that allows calculation of fission product release from the fuel sphere under limiting conditions during normal irradiation, and for incident conditions. The data describing the contamination of the primary circuit including the gas purification system are rough assessments.

11533 (Juel-Spez—335, pp 161-179) **Accidental fission product release from the plant.** Wolters, J.; Breitbach, G.; David, P.H.; Verfondern, K. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The accidental risk emanating from the HTR-Modul is decisively determined by the fission products accumulating outside the core in the primary loop during normal operation; release of these proceeds only under conditions created by the incidents of water ingress, or depressurization. The trend analysis therefore investigates the fission products depositing within the primary loop and their release and conditions of transport for the case of steam generator leakage, or leak in the primary loop pipework. The investigation is made for the radiologically important fission products cesium, strontium, and iodine.

11534 (Juel-Spez—335, pp 181-186) **Reactivity behaviour of pebble bed in the sphere discharge pipe of the HTR-modul.** Nabbi, R. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The study investigates the accident of rupture of the sphere discharge pipe and determines the reactivity data for two different configurations of equal volume, comparing the surface area. The data are obtained by two-dimensional diffusion calculations using the ASTERIX-II code. The results show a reactivity decrease of 15.3% and 42.4%, respectively.

11535 (Juel-Spez—335, pp 187-205) **Accident consequences and risk assessment.** Kroeger, W.; Degen, G. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

The accident consequences and risk assessments presented here take as a basis the results of previous studies made on the HTR-modul accidental behaviour. The event scenarios are used to assess the resulting release of fission products (type, amounts, frequency), which is classified into five release categories. Due to the design characteristics of the reactor, the core heat-up accident is not the dominating case to be studied. The investigations concentrate on events entailing release of certain amounts of fission products previously deposited on metallic surfaces of the system. The calculations made with the UFOMOD/B3 code show that for none of the release categories defined occurrence of immediate radiation effects is to be expected, even if no evacuation measures are taken.

11536 (Juel-Spez—335, pp 207-211) **Completeness of risk assessment models.** Mertens, J.; Wolters, J. Nov 1985. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751296/JAW.

In Safety related studies on the accident behaviour of the HTR-modul. Supplementary volume with detailed individual contributions on the Juel-Spez--260 report.

Completeness of risk assessment models is a control problem that becomes particularly clear through the safety analysis of the HTR-modul as with this reactor, the serious core heat-up accidents with the relevant scenarios that encompass all other type of accidental release are left out of consideration. In addition, a trend analysis that has to present data within a restricted period of time cannot be complete in this sense. The results obtained to far indicate: Only extreme external effects, or purposefully planned action of a sabotage nature are conceivalble to create accidents that would radically falsify the accident scenario taken as a basis in this study. Such effects and action are of the type that hitherto has been dealt with in all risk analyses (still) quite unsatisfactorily from the methodological point of view. Considering this fact, the trend analysis presented can be called complete.

11537 (KFK—4280) **Improvements to the fission gas model LAKU and its coupling to the pin behaviour model URANUS.** Vaeth, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Sep 1987. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751939/JAW.

The modeling of the fission gas code LAKU has been extended to describe the following effects: The resolution of fission gas from closed pores at the grain edges during steady state irradiation; the separation of grains at the boundaries during transients, caused by either fractures due to the overpressurization of grain face bubbles or by the flooding of the grain faces by released intragranular bubbles; transient grain growth; and, for frothing molten fuel, the time dependent release of the resolved gas. The improvements were performed on both the stand-alone version and URANUS-LAKU. The coupling of the two models URANUS and LAKU is described in some detail, and first results from the coupled code are presented.

11538 (NKS—85-7) **Nordic cooperation in nuclear safety. NKA's safety program 1985-1989. Distribution of responsibilities and organization.** Marcus, F. (Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark)). Jul 1986. 11p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751307/JAW.

Management of the NKA Safety Research Programme 1985-1989 involves project leaders, coordinators, and steering committees. The NKA Committee for Nuclear Safety Research (NKS) is responsible for the implementation of the entire programme. Host organizations take care of the bookkeeping and support the coordinators of individual programmes, while the project secretariat coordinates the overall budget work.

11539 (NKS—86-3) **Nordic cooperation in nuclear safety. Annual report 1985.** Soerensen, H.C. (ed.). (Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark)). Apr 1986. 67p. (In Danish and Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751308/JAW.

The activities in 1985 comprehended cooperation in nuclear waste management risk assessment, safety concepts, research in corrosion of the construction materials as well as the advanced information technology. Financing and budgets are evaluated. (EG).

11540 **(NKS—86-7) Nordic cooperation in nuclear safety. Semiannual report for the first half of 1986.** Soerensen, H.C. (ed.). (Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark)). Aug 1986. 23p. (In Danish, Swedish, and Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751309/JAW.

11541 **(NUREG—0090-Vol.10-No.2) Report to Congress on abnormal occurrences, April-June 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Nov 1987. 48p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900249/JAW.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from April 1 to June 30, 1987. The report states that for this reporting period, there were no abnormal occurrences at the nuclear power plants licensed to operate. There were five abnormal occurrences at the other NRC licensees. Three involved medical misadministrations (two diagnostic and one therapeutic); one involved the issuance of an NRC Order to remove a hospital's radiation safety officer due to falsification of certain records; and one involved a significant breakdown in management and procedural controls at an industrial radiography licensee. There was one abnormal occurrence reported by an Agreement State (Idaho). The item involved radiographer overexposures. The report also contains information updating some previously reported abnormal occurrences.

11542 **(NUREG—1002-Suppl.5) Safety evaluation report related to the operation of Braidwood Station, Units 1 and 2 (Docket Nos. STN 50-456 and STN 50-457): [Technical report, November 1983-December 1987].** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Projects III, IV, V and Special Projects). Dec 1987. 20p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900258/JAW.

In November 1983, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-1002) regarding the application filed by the Commonwealth Edison Company, as applicant and owner, for a license to operate Braidwood Station, Units 1 and 2 (Docket Nos. 50-456 and 50-457). This fifth supplement to NUREG-1002 is in support of the low-power license for Unit 2 and provides the status of certain items that remained unresolved at the time Supplement 4 was published. The facility is located in Reed Township, Will County, Illinois.

11543 **(NUREG—1231) Safety evaluation report related to Babcock & Wilcox Owners Group Plant Reassessment Program: [Final report].** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1987. 230p. NTIS, PC A11/MF A01 - GPO. Order Number TI88900167/JAW.

After the accident of Three Mile Island, Unit 2, nuclear power plant owners made a number of improvements to their nuclear facilities. Despite these improvements, the US Nuclear Regulatory Commission (NRC) staff is concerned that the number and complexity of events at Babcock and Wilcox (B and W) nuclear plants have not decreased as expected. This concern was reinforced by the June 9, 1985 total-loss-of-feedwater event at Davis-Besse Nuclear Power Station and the December 26, 1985 overcooling transient at Rancho Seco Nuclear Generating Station. By letter dated January 24, 1986, the Executive Director for Operations (EDO) informed the Chairman of the B and W Owners Group (BWOG) that a number of recent events at B and W-designed reactors have led the NRC staff to conclude that the basic requirements for B and W reactors need to be reexamined. In its February 13, 1986 response to the EDO's letter, the BWOG committed to lead an effort to define concerns relative to reducing the frequency of reactor trips and the complexity of post-trip response in B and W plants. The BWOG submitted a description of the B and W program entitled "Safety and Performance Improvement Program" (BAW-1919) on May 15, 1986. Five revisions to BAW-1919 have also been submitted. The NRC staff has reviewed BAW-1919 and its revisions and presents its evaluation in this report. 2 figs., 34 tabs.

11544 **(NUREG/CR—4944) Containment penetration elastomer seal leak rate tests.** Bridges, T.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1987. Contract AC04-76DP00789. 57p. (SAND—87-7118). NTIS, PC A04/MF A01 - GPO. Order Number TI88003217/JAW.

Tests were performed on three elastomer seal designs commonly used for nuclear plant containment mechanical penetrations. The objective of this research project is to obtain an understanding of the integrity and leakage behavior of these seal designs under severe accident temperature and pressure conditions. The three designs tested and the seal materials used in the tests were: (1) double tongue-and-groove design with silicone rubber seals, (2) double-O-ring design with neoprene and ethylene-propylene (EPDM) seals, and (3) double gumdrop design with neoprene and EPDM seals. The effects of thermal aging and angular rotations of flange mating surfaces were determined. The test results provide information required to characterize the leakage behavior of penetrations under severe accident conditions. 3 refs., 10 figs., 12 tabs.

11545 **(NUREG/CR—4965) TRAC-PF1/MOD1 US/Japanese PWR conservative LOCA prediction.** Gruen, G.E.; Fisher, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1987. Contract AC07-76ID01570. 76p. (EGG—2513). NTIS, PC A05/MF A01 - GPO. Order Number TI88003928/JAW.

This report documents the results of a 200%, double-ended, cold-leg-break, loss-of-coolant-accident (LOCA) calculation using the TRAC-PF1/MOD1 computer code. The reactor system represented a typical United States/Japanese pressurized water reactor with a 15 x 15 fuel bundle arrangement 12-ft long, four loops, and cold-leg Emergency Core Cooling (ECC) Systems. Conservation boundary and initial conditions were used. Reactor power was 102% of the 3250 MWt rated power, decay heat was set to 120% of American Nuclear Society Standard 5.1, highest core lifetime values for power peaking and fuel stored energy were used, and the LOCA occurred simultaneously with a loss of offsite power. Best estimate assumptions were used for the break flow model, fuel rod heat transfer and metal-water reaction correlations, and steady-state fuel temperature profiles. A flow blockage model, having the capability to account for the effects of cladding ballooning or rupturing, was not used. Except for these best estimate assumptions, the boundary and initial conditions were consistent with those used in licensing calculations. Maximum fuel rod temperatures were 1380 K (2020°F) and 1040 K (1410°F) on the hottest evaluation model rod and hottest best estimate rod, respectively. The high reported values or fuel cladding temperature were a direct consequence of the conservative boundary and initial conditions used for the calculation, primarily the 2% overpower condition, the core decay heat assumption, and the degraded ECCS. The calculation demonstrated successful core reflooding before 1478 K (2200°F) cladding temperature was exceeded on any fuel rod. 7 refs., 47 figs., 5 tabs.

11546 **(NUREG/CR—4966-Vol.1) Evaluation of operational safety at Babcock and Wilcox Plants: Volume 1, Results overview.** Hanson, D.J.; Meyer, O.R.; Blackman, H.S.; Nelson, W.R.; Hallbert, B.P. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1987. Contract AC07-76ID01570. 56p. (EGG—2515-Vol.1). NTIS, PC E05/MF A01 - GPO. Order Number TI88003230/JAW.

Includes 2 sheets of 24x reduction microfiche.

A methodology was developed to assess the operational performance of nuclear power plants through an integration of thermal-hydraulic and human factors analysis techniques together with inputs from information used in the assessment of risk. This methodology was applied to evaluate the extent to which plant systems and/or operator actions are effective in lessening the severity of selected transients for Babcock and Wilcox (B & W) plants. Compari-

sons were also performed to assess differences in operational performance capabilities and limitations between selected Combustion Engineering, Westinghouse, and B & W plants. Detailed results from the methodology application are presented in two volumes. This report Volume I, presents an overview of the results with emphasis on the systems and operator performance. Volume 2 presents detailed results from thermal-hydraulic calculations. 22 refs., 9 figs., 16 tabs.

11547 (NUREG/CR—4966-Vol.2) Evaluation of operational safety at Babcock and Wilcox Plants: Volume 2, Thermal-hydraulic results. Wheatley, P.D.; Davis, C.B.; Callow, R.A.; Fletcher, C.D.; Dobbe, C.A.; Beelman, R.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1987. Contract AC07-76ID01570. 47p. (EGG—2515-Vol.2). NTIS, PC E03/MF A01 - GPO. Order Number TI88003939/JAW.

Includes 2 sheets of 48x reduction microfiche.

The Nuclear Regulatory Commission has initiated a research program to develop a methodology to assess the operational performance of Babcock and Wilcox plants and to apply this methodology on a trial basis. The methodology developed for analyzing Babcock and Wilcox plants integrated methods used in both thermal-hydraulics and human factors and compared results with information used in the assessment of risk. The integrated methodology involved an evaluation of a selected plant for each pressurized water reactor vendor during a limited number of transients. A plant was selected to represent each vendor, and three transients were identified for analysis. The plants were Oconee Unit 1 for Babcock and Wilcox, H.B. Robinson Unit 2 for Westinghouse, and Calvert Cliffs Unit 1 for Combustion Engineering. The three transients were a complete loss of all feedwater, a small-break loss-of-coolant accident, and a steam-generator overfill with auxiliary feedwater. Included in the integrated methodology was an assessment of the thermal-hydraulic behavior, including event timing, of the plants during the three transients. Thermal-hydraulic results are presented in this volume (Volume 2) of the report. 26 refs., 30 figs., 7 tabs.

11548 (NUREG/CR—5037) Fire environment determination in the LaSalle Nuclear Power Plant control room. Usher, J.L.; Boccio, J.L. (Brookhaven National Lab., Upton, NY (USA)). Oct 1987. Contract AC02-76CH00016. 28p. (BNL-NUREG—52106). NTIS, PC A03/MF A01 - GPO. Order Number TI88001617/JAW.

The Fire Protection Research Program (FPRP) of the US NRC improved the modeling of environments caused by fires in typical nuclear power plant enclosures. A three-dimensional fluid dynamics computer code (PHOENICS) has been adapted as a field-model fire code (SAFFIRE) for this purpose. The model has been applied to simulate two distinct fires in the control room of the LaSalle County power plant. The environments determined illustrate hazardous potential for both personnel and equipment. 17 refs., 17 figs., 1 tab.

11549 (NUREG/CR—5042) Evaluation of external hazards to nuclear power plants in the United States. Kimura, C.Y.; Budnitz, R.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1987. Contract W-7405-ENG-48. 226p. (UCID—21223). NTIS, PC A11/MF A01 - GPO. Order Number TI88003219/JAW.

The Lawrence Livermore National Laboratory (LLNL) has performed a study of the risk of core damage to nuclear power plants in the United States due to externally initiated events. The broad objective has been to gain an understanding of whether or not each external initiator is among the major potential accident initiators that may pose a threat of severe reactor core damage or of large radioactive release to the environment from the reactor. Four external hazards were investigated in this report. These external hazards are internal fires, high winds/tornadoes, external floods, and transportation accidents. Analysis was based on two figures-of-merit, one based on core damage frequency and the other based on the frequency of large radioactive releases. Using these two figures-of-merit as evaluation criteria, it has been feasible to ascertain whether the risk from externally initiated accidents is, or is not, an important contributor to overall risk for the US nuclear power plants studied. This has been accomplished for each initiator separately. 208 refs., 17 figs., 45 tabs.

11550 (PNL-SA—15077) Decommissioning of first-generation nuclear power plants in the United States. LaGuardia, T.S.; Smith, R.I. (TLG Engineering, Inc., Bridgewater, CT (USA); Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 20p. (CONF-870911—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88001900/JAW.

From International conference on the technical and economic performance of nuclear power; Vienna, Austria (28 Sep 1987).

The plans and estimated costs for the first-generation of utility nuclear power plants in the United States are discussed in this paper. These plans are being prepared to satisfy utility planning needs and regulatory requirements to establish a basis for collecting a decommissioning fund from a charge to the ratepayers. The technology to be used in the dismantlement is summarized, including the plans for waste transportation and disposal. Estimates of radioactive waste volumes and worker exposures are presented. The estimated costs for decommissioning are provided for the principal categories of dismantlement activities in decommissioning the first-generation pressurized water reactors and boiling water reactors. Relevant experience from decommissioning projects and related reactor operations maintenance activities in the USA is presented.

11551 (SAND—87-1989C) MELCOR in-vessel modeling. Summers, R.M.; Webb, S.W.; Cole, R.K.; Dingman, S.E. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 26p. (CONF-8710111—15). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003794/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

MELCOR is a fully integrated computer code that models the progression of severe accidents in LWR nuclear power plants. MELCOR is being developed at Sandia for the USNRC as the successor to the Source Term Code Package. The entire spectrum of severe accident phenomena is treated in MELCOR in a unified code framework. This paper describes the in-vessel modeling in MELCOR in the areas of thermal-hydraulics, core heat transfer and melt progression, and radionuclide release and transport. Results from a preliminary MELCOR calculation for a short term, high pressure, station blackout scenario at LaSalle are presented to illustrate the effects of core relocation and natural circulation on the course of the accident. 17 refs., 16 figs., 3 tabs.

11552 (SAND—87-2051C) Calculation of source terms for NUREG-1150. Breeding, R.J.; Williams, D.C.; Murfin, W.B.; Amos, C.N.; Helton, J.C. (Sandia National Labs., Albuquerque, NM (USA); Technadyne Engineering Consultants, Inc., Albuquerque, NM (USA); Arizona State Univ., Tempe (USA)). Oct 1987. Contract AC04-76DP00789. 15p. (CONF-8710111—18). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003633/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

The source terms estimated for NUREG-1150 are generally based on the Source Term Code Package (STCP), but the actual source term calculations used in computing risk are performed by much smaller codes which are specific to each plant. This was done because the method of estimating the uncertainty in risk for NUREG-1150 requires hundreds of source term calculations for each accident sequence. This is clearly impossible with a large, detailed code like the STCP. The small plant-specific codes are based on simple algorithms and utilize adjustable parameters. The values of the parameters appearing in these codes are derived from the available STCP results. To determine the uncertainty in the estimation of the source terms, these parameters were varied as specified by an expert review group. This method was used to account for the uncertainties in the STCP results and the uncertainties in phenomena not considered by the STCP.

11553 **(SAND—87-2072C) Integration of the NUREG-1150 analyses: Calculation of risk and propagation of uncertainties.** Helton, J.C.; Griesmeyer, J.M.; Haskin, F.E.; Iman, R.L.; Amos, C.N.; Murfin, W.B. (Sandia National Labs., Albuquerque, NM (USA); Arizona State Univ., Tempe (USA); Technadyne Engineering Consultants, Inc., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 26p. (CONF-8710111—17). NTIS, PC A03. Order Number DE88003993/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

The calculation of risk and the propagation of uncertainties in the US Nuclear Regulatory Commission's reassessment of risk from commercial nuclear power stations (i.e., NUREG-1150) is described. The overall integration of the analysis performed for each nuclear power station considered in NUREG-1150 is based on: (1) relatively fast-running models for the individual parts of the analysis, (2) well-defined interfaces between the individual parts of the analysis, (3) definition of selected issues for uncertainty analysis, (4) use of Monte Carlo procedures in conjunction with an efficient sampling technique (i.e., Latin hypercubs sampling) to propagate uncertainties, and (5) automation of the overall analysis. The preceding approach is described and then illustrated with the analysis performed for the Peach Bottom nuclear power station. 56 refs., 4 figs., 3 tabs.

11554 **(SAND—87-2096C) Recent advances in the CONTAIN code.** Bergeron, K.D.; Carroll, D.E.; Gelbard, F.; Murata, K.K.; Valdez, G.D.; Washington, K.E. (Sandia National Labs., Albuquerque, NM (USA); Technadyne Engineering Consultants, Inc., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 13p. (CONF-8710111—21). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003258/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

An update is given on very recent developments involving CONTAIN, the USNRC's principal mechanistic code for severe accident containment analysis. First, the features are outlined in two major new releases of CONTAIN. Revision 1.06 was released in February; the major improvements include full integration of the CORCON and VANESA models for debris concrete interactions and concomitant aerosol generation, more detailed and more flexible radiation heat transfer options, and a number of minor improvements. The most recent new version of the code is CONTAIN 1.1, which was released in October. The principal new features relate to the Boiling Water Reactor. In particular, working models are included for Pressure Suppression Pools and Safety Relief Valves. In addition, this version of the code has a much-improved treatment of fision product hosting, user-defined material property options, and a number of other improvements. A second major area of progress involves the aerosol models. Previously, numerical diffusion limited the accuracy of the calculation of the concentration of the smallest particles and, there was no accounting for the effects of soluble salts or surface tension on the equilibrium water vapor pressure. All of these problems have now been solved with a stand-alone aerosol modeling code which uses a suite of new numerical approaches. The new methods have been incorporated into CONTAIN. Example calculations are presented. 7 refs., 4 figs., 1 tab.

11555 **(STUK-A—56) Airborne radioactivity in Finland after the Chernobyl accident in 1986. Supplement 1 to annual report STUK-A55.** Sinkko, K.; Aaltonen, H.; Mustonen, R.; Taipale, T.K.; Juutilainen, J. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751315/JAW.

In the air surveillance programme of the Finnish Centre for Radiation and Nuclear Safety concentrations of artificial radionuclides are monitored in the air close to the ground. Airborne dust is collected continuously on a class fibre filter by a high-volume air sampler at Nurmijaervi, 40 km north of Helsinki, and the concentrations of radionuclides are evaluated. Extensive studies on radionuclide composition in air and spatial distribution were performed in Finland after the Chernobyl accident. The fallout situation was followed by temporary air sampling in Helsinki and Rovaniemi, with short sampling periods and also with air dust samples from the upper atmosphere. In Nurmijaervi, air samples were also taken on an activated carbon bed. All samples were measured by gamma-spectrometry, but some radiochemical analyses were also performed. Fallout from Chernobyl arrived in Finland on Sunday, April 27. The maximum concentrations in air were measured on Monday evening, April 28, and ranged from a few microbecquerels to two hundred becquerels per cubic metre. At an altitude of about 1500 m the concentrations of radionuclides were even two decades higher. The radionuclide concentrations in air decreased rapidly being under one hundredth part of their maximum values after few days.

11556 **(STUK-A—57) Radioactivity of wet and dry deposition and soil in Finland after the Chernobyl accident in 1986. Supplement 2 to annual report STUK-A55.** Saxen, R.; Taipale, T.K.; Aaltonen, H. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751316/JAW.

To monitor the amounts and areal distribution of radioactive substances deposited in Finland, the Finnish Centre for Radiation and Nuclear Safety has 18 stations continuously collecting wet and dry deposition. The sampling period is usually one month, but after the Chernobyl accident sampling periods were shortened at some stations. This was done to follow up the temporal variations in amounts of radioactive substances deposited in Finland. Sampling also began at some new stations. In addition some surface soil samples were taken from sites, supplementing the deposition sampling. All the samples were analysed for gamma-emitting radionuclides. Strontium isotopes, /sup 89/Sr and /sup 90/Sr, were determined on the majority of the deposition samples, as well as transuranic elements on the surface soil samples and some of the deposition samples. The results show that the Chernobyl fallout in Finland was unevenly distributed areally. The areal distribution of the two long-lived radionuclides, /sup 90/Sr and /sup 137/Cs, was different. The highest annual /sup 137/Cs deposition from these stations was detected at Niinisalo (32000 Bq m/sup -2/) and the lowest at Taivalkoski (140 Bq m/sup -2/). The highest total deposition of /sup 90/Sr up to the end of June was detected in Kuhmo (570 Bq m/sup -2/). This is probably due to the deposition of dispersed uranium fuel elements from Chernobyl. The presence of these fuel fragments was verified by the composition of the other gamma-emitters in the deposition samples. The dominant alpha-emitting transuranic nuclide in Chernobyl fallout was /sup 242/Cm, but the proportion of transuranic elements in the total fallout was small. The highest amounts of /sup 239,240/Pu and /sup 242/Cm were 0.01% and 0.02%, respectively, of the amounts of /sup 137/Cs.

11557 **(STUK-A—64) Radioactivity of people in Finland after the Chernobyl accident in 1986. Supplement 9 to annual report STUK-A55.** Rahola, T.; Suomela, M.; Illukka, E.; Puhakainen, M.; Pusa, S. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751319/JAW.

After the reactor accident at Chernobyl on April 26, 1986 radioactive fallout was carried by air currents to most parts of Europe. The radioactive air currents reached Finland on April 27. Immediately after the arrival of such air in Finland, contamination of people by radioactive nuclides began via inhalation of this air. The ingestion route become important later, when radionuclides were transported via different foodchains to man. To determine the level of radionuclides in the body and to estimate the internal radiation doses caused by the Chernobyl accident, whole-body counting measurements were performed. The results of whole-body counting of six different groups of Finnish people measured during 1986 after the accident at Chernobyl are reported. Three were reference groups measured routinely once or twice annually, two groups were comprised of workers at nuclear power stations and one group consisted of 262 persons not belonging to any other group. The total number of whole-body counting measurements of persons in these groups in 1986 from the end of April to the end of December was 624. In April and May small amounts of /sup 131/I were detected in the thyroid. In June the first signs of /sup 134/Cs in the body were noticed. At the end of 1986 the mean /sup 134/Cs body burden for women and men in the Helsinki reference

group was 730 Bq. The mean /sup 137/Cs body burden in women and men increased from 150 Bq in June to 1500 Bq in December. The differences in the deposition levels in the five fallout regions into which Finland was divided were reflected in the activity levels of the measured people. The weighted annual mean body burden for people in Finland at the end of 1986 was 370 Bq /sup 134/Cs and 820 Bq /sup 137/Cs. The maximum body burdens of /sup 134/Cs and /sup 137/Cs found in Finns in 1986 were 6300 Bq and 13000 Bq, respectively.

11558 **(STUK-A—65) Environmental gamma radiation measurements in Finland and the influence of the meteorological conditions after the Chernobyl accident in 1986. Supplement 10 to annual report STUK-A55.** Arvela, H.; Blomqvist, L.; Lemmelae, H.; Savolainen, A.L.; Sarkkula, S. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751320/JAW.

Results from a survey of environmental gamma radiation levels in Finland after the Chernobyl accident 1986 were presented. The measurements were made by means of sensitive Geiger-counters and a gamma-spectrometer placed in cars. The results presented the level of external radiation caused by the cesium fallout on the first of October 1986. In the center of Southern Finland there are wide areas with exposure levels exceeding 0.04 μSv h/sup -1/, areas exceeding 0.2 μSv h/sup -1/ being very rare. The surface area weighted mean dose rate for the 461 municipalities in Finland was 0.037 muSv h/sup -1/ (range 0-0.23 μSv h/sup -1/). The corresponding estimated surface activity of /sup 137/Cs was 10.7 kBq m/sup -2/. The population weighted mean dose rate was 0.051 μSv h/sup -1/. Results from measurements at eight dose rate monitoring stations were presented as daily dose rate recordings in 1985-1986, the rate of decrease of the excess dose rate demonstrating quite large variations in the period from May to August. This indicated that the composition of the short-lived nuclides in the fallout varied from place to place. The influence of the meteorological conditions were reported with precipitation data from six days after the accident. There was a clear correlation between the results from precipitation and radiation measurements in different parts of Finland.

11559 **(TPR-NS—28-No.4) Nuclear Safety: Technical progress review, October-December 1987.** Silver, E.G. (ed.). (Oak Ridge National Lab., TN (USA)). 1987. 162p. GPO $7.50. Order Number TI87011505/JAW.

This review journal covers significant developments in the field of nuclear safety. Its scope includes the analysis and control of hazards associated with nuclear energy, operations involving fissionable materials, and the products of nuclear fission and their effects on the environment. Primary emphasis is on safety in reactor design, construction, and operation; however, the safety aspects of the entire fuel cycle, including fuel fabrication, spent-fuel processing, nuclear waste disposal, handling of radioisotopes, and environmental effects of these operations, are also treated. Topics addressed in this volume are: The Chernobyl Accident; General Safety Considerations; Accident Analysis; Control and Instrumentation; Plant Safety Features; Environmental Effects; Operating Experiences; and Recent Developments. Seventeen articles have been cataloged separately.

11560 **Chernobyl accident: Assessing the data.** Soerensen, B. (Roskilde Univ., Denmark). *Nuclear Safety;* **28**: No. 4, 443-447(Oct-Dec 1987).

Data presented in the official USSR report to the International Atomic Energy Agency on the Chernobyl Atomic Energy Station accident are critically assessed. Special attention is given to the derivation of release fractions from fallout measurements, a procedure demonstrated to involve large elements of uncertainty. Further comments relate to estimates of plume rise and deposition velocity. A comparison is made with the predictions of previously published theoretical reactor safety studies.

11561 **An examination of the accident scenario in the Chernobyl Nuclear Power Station.** Ishikawa, Michio; Shiozawa, Shusaku; Wakabayashi, Toshio; Ohnishi, Nobuaki; Mochizuki, Hiroyasu. (Japan Atomic Energy Research Institute, Tokai, Ibaraki; Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki, Japan). *Nuclear Safety;* **28**: No. 4, 448-454(Oct-Dec 1987).

The accident scenario in the Chernobyl Nuclear Power Station was examined by using EUREKA-2 analyses and the experimental results from the Nuclear Safety Research Reactor. The accident scenario is characterized by two power excursions, pressure tubes bursting from rapid steam generation resulting from molten fuel dispersion into the coolant, heatup caused by zirconium-water or zirconium-air reaction and subsequent burning of graphite rings, and a graphite moderator fire. These events can be explained quantitatively without conflict with the report submitted by the USSR State Committee to the International Atomic Energy Agency Experts' Meeting in August 1986.

11562 **NRC Technical Training Center.** Anderson, R.L.; Raglin, K.A.; Grimes, B.K. (Nuclear Regulatory Commission, Chattanooga, TN; Nuclear Regulatory Commission, Washington, DC). *Nuclear Safety;* **28**: No. 4, 455-461(Oct-Dec 1987).

The US Nuclear Regulatory Commission (NRC) regulates civilian uses of nuclear materials to ensure the protection of public health and the safety of the environment. The NRC Technical Training Center (TTC) develops and implements the policy and program for training of NRC inspectors and provides technical training for NRC personnel and other government agencies as requested. The TTC provides or coordinates training in nuclear power-plant design and operation; inspection techniques; physical security; health physics; and such disciplines as welding, nondestructive testing, and quality assurance. The TTC leases time on several light-water-reactor control-room simulators.

11563 **Quantified safety objectives in high technology: Meaning and demonstration.** Vinck, W.F.; Gilby, E.V.; Chicken, J.C. (Commission of the European Communities, Brussels, Belgium; Gilby Associates, Knutsford, United Kingdom; J.C. Consultancy, Ltd., Godalming, United Kingdom). *Nuclear Safety;* **28**: No. 4, 461-471(Oct-Dec 1987).

This article, drawn from a paper presented at the International ANS/ENS Topical Meeting on Thermal Reactor Safety, February 2-6, 1986, San Diego, California, reports ongoing work performed within groups sponsored by the Commission of the European Communities and draws on reports provided by the authors as consultants. It gives an overview and trends analysis of the types of quantified criteria and objectives presently applied or envisaged and discussed in Europe in the nuclear application, specifically nuclear power plants, and in nonnuclear applications, specifically in the chemical and petrochemical process industry. The article makes some comparative deductions and addresses the similarities or discrepencies between such criteria and objectives and the problems associated with the demonstration of compliance. It briefly discusses the role of cost effectiveness of risk reduction and mentions an effort to combine the technical, economic, and sociopolitical factors playing a role in risk acceptance.

11564 **A review of "Engineering safety assessment: An introduction".** Staunton, R.H. (Oak Ridge National Lab., TN). *Nuclear Safety;* **28**: No. 4, 471-472(Oct-Dec 1987).

This paperback book, published by John Wiley and Sons in 1987, by British author J.R. Thomson, provides an interesting overview of the current means of assessing the safety of hazardous industrial plants. Although the text is fairly short, it provides detailed information regarding numerous approaches to the main topic as well as background in basic probability and systems reliability. This review discusses the topics introduced in each chapter and the presentation of these topics.

11565 **Power-plant simulation and reactor safety.** Hetrick, D.L. (Univ. of Arizona, Tucson). *Nuclear Safety;* **28**: No. 4, 473-486(Oct-Dec 1987).

This article is a review of developments in nuclear power-plant simulation that are particularly relevant to nuclear plant safety. This includes complex fast interactive systems called plant analyzers, intermediate-size modular systems, and small simulators used for preliminary studies and for illustrating concepts. Applications include safety analysis, computer-assisted plant operation, and test beds for design of control systems, disturbance analysis systems, and expert systems for automated plant operation.

11566 **Post-accident sampling systems and analysis techniques.** Davidson, G.R. (Sargent and Lundy Engineers, Chicago, IL). *Nuclear Safety;* 28: No. 4, 487-493(Oct-Dec 1987).

This article examines nuclear power-plant post-accident sampling and analysis systems built in response to requirements issued by the US Nuclear Regulatory Commission after the accident at Three Mile Island Nuclear Station Unit 2. The requirements are summarized, and the chemical and radiological analysis techniques employed to meet them are described and assessed.

11567 **Special topics relative to the development of an optimized inherently safe liquid-metal reactor.** Coffield, R.D.; Markley, R.A.; Schmidt, J.E.; Doncals, R.A.; Kalinowski, J.E. (Westinghouse Electric Corp., Madison, PA). *Nuclear Safety;* 28: No. 4, 494-505(Oct-Dec 1987).

Reactor technology improvements have made the development of an inherently safe liquid-metal reactor (LMR) possible. Westinghouse is using this technology to develop innovative design features that will preclude hypothetical core-disruptive accidents. Key to the development of an inherently safe LMR is the optimization of the various thermal-hydraulic and nuclear design parameters. This article describes this process with particular focus on several of the more significant parameters and then describes a series of tests that could be performed in a fast flux test facility to demonstrate proof of principle and provide a verification data base relative to LMR inherent safety.

11568 **The chemistry of fission-product iodine under nuclear reactor accident conditions.** Malinauskas, A.P.; Bell, J.T. (Oak Ridge National Lab., TN). *Nuclear Safety;* 28: No. 4, 505-514(Oct-Dec 1987).

Radioisotopes of iodine are generally acknowledged to be the species whose release into the biosphere as a result of a nuclear reactor accident is of greatest concern. In the course of its release, the fission product is subjected to differing chemical environments; these can alter the physicochemical form of the fission product and thus modify the manner in and extent to which release occurs. Both the chemical environments that are characteristic of reactor accidents and their effect in determining the physical and chemical form of fission-product iodine have been studied extensively and are reviewed in this article.

11569 **A review of validation studies for the Gaussian plume atmospheric dispersion model.** Miller, C.W.; Hively, L.M. (Illinois Dept. of Nuclear Safety, Springfield; Dept. of Energy, Washington, DC). *Nuclear Safety;* 28: No. 4, 522-531(Oct-Dec 1987).

The Gaussian plume model is the atmospheric dispersion model most widely used for estimating airborne radionuclide exposures within 80 km of the release point. The best overall uncertainty determination for such a model is a comparison of modeling predictions with environmental measurements for conditions similar to those assumed by the model. This article reviews such published comparisons and indicates that annual average air concentrations over flat terrain can be predicted within a factor of 2 to 4 using the Gaussian plume model. However, the accuracy of this model decreases as the averaging time decreases and/or the complexity of the meteorological and terrain conditions increases. More validation studies are needed to determine whether more-complex models should supplement the Gaussian model in radiological assessments under some circumstances. This review can provide guidance to decision makers who use Gaussian plume model predictions in specific radiological dose assessments such as those found in environmental impact statements and safety analysis reports.

11570 **Fuel performance annual report for 1985.** Bailey, W.J. (Pacific Northwest Lab., Richland, WA). *Nuclear Safety;* 28: No. 4, 532-549(Oct-Dec 1987).

This article provides a summary describing fuel performance during 1985 in domestic commercial nuclear power plants and an indication of trends. Brief summaries of fuel design changes, fuel surveillance programs, fuel operating experience, fuel problems, high-burnup fuel experience, and items of general significance are provided. References to additional, more-detailed information and related US Nuclear Regulatory Commission evaluations are included.

11571 **Reactor shutdown experience.** Cletcher, J.W. (comp.). *Nuclear Safety;* 28: No. 4, 549-551(Oct-Dec 1987).

This section presents a regular report of summary statistics relating to recent reactor shutdown experience. The information includes both numbers of events and rates of occurrence. It was compiled from data about operating events entered into the SCSS data system by the Nuclear Operations Analysis Center at the Oak Ridge National Laboratory.

11572 **Operating US power reactors.** Silver, E.G. (comp.). *Nuclear Safety;* 28: No. 4, 552-568(Oct-Dec 1987).

This update surveys the operations of those power reactors in the United States which have been issued operating licenses. The number of such reactors and their net capacities as of June 30, 1987, are shown. The unit capacity and forced outage rate for each licensed reactor is listed for each of the three months (April, May, and June 1987) covered in this report and the cumulative values of these parameters since the beginning of commercial operation.

11573 **General administrative activities.** Silver, E.G. (comp.). *Nuclear Safety;* 28: No. 4, 569-578(Oct-Dec 1987).

This section summarizes selected current topics that are related to nuclear safety but do not fit elsewhere in the journal. Included in this report are items reported during April, May, and June 1987. Subjects discussed, among others, are proposed legislation on rail shipments of high-level waste through densely populated areas, Advisory Committee on Reactor Safeguards (ACRS) comments on US Nuclear Regulatory Commission (NRC) research plans to reduce source term uncertainties and on the NRC implementation plan for the safety goal policy, and a Congressional hearing on legislation that would require data links between all nuclear plants and the NRC to be used in emergencies.

11574 **Reports, standards, and safety guides.** Queener, D.S. *Nuclear Safety;* 28: No. 4, 578-583(Oct-Dec 1987).

This article contains four lists of various documents relevant to nuclear safety as compiled by the editor. These lists are: (1) reactor operations-related reports of US origin, (2) other books and reports, (3) regulatory guides, and (4) nuclear standards. Each list contains the documents in its category which were published (or became available) during the three-month period (April, May, and June 1987) covered by this report. The availability and cost of the documents are noted in most instances.

11575 **Status of power-reactor projects undergoing licensing review.** Silver, E.G. (comp.). *Nuclear Safety;* 28: No. 4, 584-590(Oct-Dec 1987).

Recent regulatory and other actions relating to US power reactors undergoing these steps toward licensing are summarized for the second quarter of 1987. This section also contains brief reports of regulatory actions and other significant events relating to reactor projects in the licensing stage that were received during the period covered by this report, namely, the second quarter of 1987.

11576 **The integral fast reactor.** Till, C.E. (Argonne National Lab., Argonne, IL). *Journal of Nuclear Materials Management;* 16: 19-23(Jul 1987). (CONF-870713—). Contract W-31-109-ENG-38.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

On April 3rd, 1986, two dramatic demonstrations of the inherent capability of sodium-cooled fast reactors to survive unprotected loss of cooling accidents were carried out on the experimental sodium-cooled power reactor, EBR-II, on the Idaho site of Argonne National Laboratory. Transients potentially of the most serious kind, one an unprotected loss of flow, the other an unprotected

loss of heat sink, both initiated from full power. In both cases the reactor quietly shut itself down, without damage of any kind. The contrast between the consequences of these events in EBR-II and the Chernobyl events just twenty-three days later thrust EBR-II, and the underlying Integral Fast Reactor development program at Argonne, into the national news. The paper describes the IFR concept, the inherent safety tests, and status of IRF development today.

11577 **Vital area determination techniques at nuclear power plants.** Pan, P.Y. (Los Alamos National Lab., Los Alamos, NM 87544). *Journal of Nuclear Materials Management;* 16: 166-168(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This paper describes the vital area determination programs being conducted at the Los Alamos National Laboratory to support the Nuclear Regulatory Commission (NRC) in evaluating nuclear power plant licensees' compliance with safeguards/security requirements. These projects, the Vital Area Analysis (VAA) Program and the Vital Equipment Determination Techniques Research Study (VEDTRS), are designed to identify a plant's vital areas and to develop protection strategies against adversary threats in nuclear power plants.

11578 **Integrated phenomenological analysis of containment response to severe core damage accidents.** Williams, D.C.; Bergeron, K.D.; Rexroth, P.E.; Tills, J.L. (Sandia National Labs., Albuquerque, NM, USA). *Progress in Nuclear Energy;* 19: No. 1, 69-131(1987). Contract AC04-76DP00789.

The development and some recent applications of the CONTAIN code, which offers an integrated treatment of the dominant containment phenomena and the interactions among them are described. The results are given of a series of containment phenomenology studies, based upon realistic accident sequence analyses in actual plants, which highlight various phenomenological effects that have potentially important implications for source term and/or containment loading issues, and which are difficult or impossible to treat using a less integrated code suite. Results are also presented for applications of CONTAIN to the quantitative estimation of uncertainties in the source term which arise because of uncertainties in containment phenomenology. Taken together, the results described here show that analyses with nonintegrated, separate-effects codes can neglect interactions that are important to the source term and, furthermore, it is impossible to generalize whether the errors in such treatments would be 'conservative' or 'nonconservative'. In many cases, it was not possible to predict in advance whether the phenomenological couplings would prove important or what the nature of their effects would be; the integrated treatment was required in order to obtain even qualitative answers to these questions. It is concluded, therefore, that integrated phenomenological analysis will play an increasingly important role as the technology for severe accident analysis matures.

11579 **Ex-vessel releases: aerosol source terms in reactor accidents.** Brockman, J.E. (Sandia National Labs., Albuquerque, NM, USA). *Progress in Nuclear Energy;* 19: No. 1, 7-68(1987). Contract AC04-76DP00789.

An ex-vessel aerosol and fission-product source term may arise from various events occurring in the containment building of a nuclear reactor. The research into the source terms associated with three of these events is reviewed. These source terms are from steam explosions, pressurized melt ejection, and melt/concrete interaction. The least is known about the steam explosion source term. Analyses indicate that its magnitude is likely lower than that assumed in the Reactor Safety Study WASH-1400), but no conclusive experimental data are as yet available. The aerosol and fission-product source term from pressurized ejection of melt is an issue only recently addressed. Experimental evidence has allowed estimates to be made of the magnitude of this source term. The source term from melt/concrete interaction has been long recognized and has the largest data base. Experimental programs have addressed this source term for several years. A mechanistic model of material release has been developed and is discussed.

11580 **Extended overpower transient testing of LMFBR oxide pins in EBR-II.** Tsai, H.; Neimark, L.A.; Tani, S.; Shibahara, I. (Argonne National Lab., IL, USA; Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki, Japan. Oarai Engineering Center). pp vp of Nuclear fuel performance. Volume 1 of 2 . London, England; British Nuclear Energy Society (1985). (CONF-850398—).

From British Nuclear Energy Society nuclear fuel performance meeting; Stratford-upon-Avon, UK (25 Mar 1985).

As part of a joint effort between the Power Reactor and Nuclear Fuel Development Corp. of Japan and the U.S. Department of Energy, a series of five extended slow overpower transient tests are being conducted in the Experimental Breeder Reactor-II (EBR-II) on preirradiated mixed oxide fuel and blanket pins. In the first two tests conducted in the series, fuel and blanket pins were subjected to a 0.1%/s power ramp to approx. 60% overpower before the transient termination. None of the test pins breached during the transient. A significant cladding breaching margin over the normal PPS trip setting of approx. 12-15% was thus demonstrated for the 0.1%/s ramp. The transient-induced pin cladding strains, caused principally by fuel-cladding mechanical interaction, were small but measurable.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 11189

2502 Compressed Gas

REFER ALSO TO CITATION(S) 11187

2505 Flywheels

11581 **Advances in flywheel performance for space power applications.** Olszewski, M.; O'Kain, D.U. (Oak Ridge National Lab., TN, USA; Oak Ridge Gaseous Diffusion Plant, TN, USA). *Endeavour;* 11: No. 2, 58-62(1987).

Power derived from stored energy rather than directly from the primary thermal source is an attractive alternative in certain space applications. To meet the stringent requirements for space needs will, however, require that flywheel performance be advanced from its current levels. Previous flywheel development programmes focused on the use of composite materials and resulted in storage densities, at ultimate speed, of 286 kJ/kg being attained. More recent work, directed at the space application, has advanced flywheel storage densities at ultimate speed to 878 kJ/kg.

2506 Thermal

REFER ALSO TO CITATION(S) 11319, 11471, 11472

11582 **(ANL/CNSV-TM—177) Third international workshop on ice storage for cooling applications.** Gorski, A.J. (comp.). (Argonne National Lab., IL (USA)). Apr 1986. Contract W-31109-ENG-38. 54p. (CONF-8311308—Absts.). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88000980/JAW.

From 3. international workshop on ice storage for cooling applications; Argonne, IL, USA (21 Nov 1983).

The third international workshop on ice storage for cooling applications which was informal and interactive in nature, was open to persons interested in all ice-growing technologies and in ice storage, both seasonal and diurnal. Presentations were made on some 20 topics, ranging from freezers in Alaska to ice cooling of commercial jet aircraft. Workshop tours included visits to ice-storage systems at Commonwealth Edison's facilities in Bolingbrook and Des Plaines Valley, the A.C. Neilsen builing in Northbrook, and the new State of Illinois Center in Chicago. The first workshop in the present series considered the future of ice storage and predicted applications in the agricultural sector, desalinization, and commercial ice production. Progress has been rapid in the intervening two years, and an important topic at the third workshop was the possi-

ble use of "warm ices" (clathrate hydrates) for energy storage. This report consists primarily of abstracts of presentations made at the workshop. Persons wishing to obtain further information about particular papers should contact the speakers directly; speakers' addresses and telephone numbers are listed in this report.

11583 (BMFT-FB-T—86-219) Potential for the application of thermal energy storage systems with temperatures of more than 100degC in the German industry. Final report. Lambrecht, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 213p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88750991/JAW.

In industry segments such as iron and steel production, aluminium smelting and refining, iron and steel foundries, ceramics, and textiles various processes were investigated for their suitability for the use of high-temperature thermal energy storage systems (HTES). 5 industrial plants including promising processes were analysed further in cooperation with the users. Data for cost-benefit analysis of HTES were collected and applied to the five industrial situations analysed. In the iron and steel, aluminium, and ceramic industries situations were identified for which the use of HTES appears technically and economically feasible. Proposals were presented for the development of HTES moduls having a broad field of application in industry. With 103 refs., 25 tabs., 77 figs.

11584 (EPRI-EM—5454-SR) Seminar proceedings: Commercial cool storage: State of the Art: Special report. (Electric Power Research Inst., Palo Alto, CA (USA)). Oct 1987. 195p. (CONF-870273—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920086/JAW.

From Seminar on commercial cool storage: state of the art; Denver, CO, USA (19 Feb 1987).

This seminar was designed to meet the needs of utility customer service representatives and planners, the design community, and cool storage systems vendors. The seminar presentations were on current technology, recent product advances, product developments in progress, emerging technologies, future needs, and utility marketing programs. Cool storage was presented from the perspective of utilities, designers, vendors and researchers.

11585 (JSES—602, pp 105-108) Study on heat loss reduction in underground aquifer heat storage method. Umemiya, Hiromichi; Shimawaki, Susumu. (Yamagata Univ., Faculty of Engineering, Yamagata, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Heat losses are measured upon injection and recovery with thermal storage. Casing heat transfer rate is calculated for injection and recovery by assuming the heat losses as heat transfer phenomena from the casing. According to the heat storage test, it appears possible to improve the heat recovery coefficient, in terms of a ratio of recovered heat to injected heat, can be improved from 23% in the first cycle to 60% in the fifth cycle. To reduce casing heat losses, it is possible to suppress heat losses to 1/2 by using the double-wall pumpin pipe. The losses can be suppressed to 2/5 by covering the pumping pipe with heat insulation. The economic performance of the underground aquifer heat storage system is proved to be excellent because a performance coefficient, a ratio of effectively used heat to charged electric power, is 10.5. The number of depreciation years is calculated at 13 with a calculated initial cost, a heat recovery rate of 60% and a performance coefficient of 30. (11 figs, 2 tabs)

11586 (PB—88-109939/XAB) Thermal-energy-storage technology in Sweden: R and D program, technology, economics, application. Lundin, S.E.; Hyden, H.; Andersson, S.; Sabel, H.; Gustafson, G. (SEE CODE- 5964200 Swedish Council for Building Research, Stockholm). 1987. 6p. (D—10:1987). NTIS, PC E04/MF A01.

Contents include: aquifer heat storage technology in sweden; thermal energy storage technology; ground heat storage technology; seasonal storage of heat for district heating; heat storage in caverns, tanks and pits; R & D in energy storage - a field of interest for building contractors.

11587 (SU-BS—83) Review of storage systems used in building applications. Hariri, A.S.; Ward, I.C. (Sheffield Univ. (UK). Dept. of Building Science). Oct 1986. 29p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks LS23 7BQ.

This report presents a review of thermal storage systems commonly used in building applications. Emphasis is on sensible and latent heat storage systems. A theoretical background prepares the reader for the practical usages. Some thermodynamics relations are included. Solid and liquid sensible heat storage systems are presented in two different sections. Latent heat storage systems are discussed in a separate section. The applications and drawbacks of each system with reference to building applications are reviewed. The last section is reserved for the containers of both heat storage systems.

2508 Chemical

REFER ALSO TO CITATION(S) 11587

11588 (JSES—602, pp 113-116) Operation result of chemical heat storage experimental apparatus provided with Na_2S hydrate using mechanical draft (Part 2). Tajiri, Koji; Asahina, Tadashi; Kosaka, Mineo. (Government Industrial Research Inst. Nagoya, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

This paper presents part of operation result of the chemical heat storage apparatus with the heat storage tank packed with sodium sulfide tetra-hydrate and the thermophysical properties of the hydrate determined to decide the operating condition. Several diagrams of temperature-equilibrium vapor pressure of hydrate in aqueous composition were drawn. The results indicate that the temperature difference is approximately 55°C in the presence of sodium sulfide hydrate together with water. The heat storage material was prepared by dipping ceramic foam in molten $Na_2S.5H_2O$. The experiment was carried out at the flow rate of carrier gas of 200 l/min and inlet temperature of heat storage tank of 84°C. Chemical heat storage was successfully made for one to two hours, but the heat was increasingly transferred to the heat exchanger with the lapse of time. The heat loss was, therefore, increased and the outlet temperature of heat storage tank was lowered. The reaction rate was also low and the temperature rise was 10°C or less. (2 refs, 8 figs, 1 tab)

2509 Batteries

REFER ALSO TO CITATION(S) 11752

11589 (AD-A—184883/7/XAB) High-energy-density rechargeable batteries for aerospace power requirements. Technical report. Zimmerman, A.H.; Speckman, D.M. (Aerospace Corp., El Segundo, CA (USA). Laboratory Operations). 3 Aug 1987. 37p. (TR—0086A(2945-01)-1). NTIS, PC A03/MF A01.

In light of power requirements for search missions, the rechargeable-battery and fuel-cell technologies that are expected to be available for these missions are identified, and areas of technology development that will be required for each energy-storage system are indicated. The general conclusions are that the nickel-cadmium and nickel-hydrogen battery systems will be able to satisfy the space power needs through the early 1990s, after which a significantly higher-energy-density system will be required, particularly for geosynchronous and mid-altitude orbit missions. The sodium-sulfur battery is the only system projected to meet the requirements of the most power-intensive missions that are expected to operate in higher orbits by the mid-1990s. For low-earth-orbit missions the nickel-hydrogen battery system is expected to provide the required power levels, except in situations where very high

peak-power levels are required. The hydrogen-oxygen regenerative fuel cell is best suited to satisfying the high peak power needs in large power systems, but must undergo significant development to obtain the needed system life.

11590 **(AD-A—185451/2/XAB) Rechargeable cadmium-bromine battery using room-temperature chloroaluminate molten salts.** Dymek, C.J.; Reynolds, G.F.; Wilkes, J.S. (Air Force Academy, CO (USA). Frank J. Seiler Research Lab.). Jul 1987. 7p. (FJSRL-JR—87-0004). NTIS, PC A02/MF A01.

Pub. in Jnl. of the Electrochemical Society, Vol. 134, No. 7, 1658-1663(Jul 1987).

Galvanic cells were tested using as electrolytes room temperature molten salts formed by mixing A1C13 with 1-methyl-3-ethylimidazlium chloride (ME1c1), Zn and Cd, each with basic melt (containing C1 ions and A1C14 ions) were the anodes, Br_2 dissolved in basic melt with a reticulated vitreous carbon current collector was the cathode in each case. ME1 selective Nafion was used as a separator. The Zn electrode was found to be irreversible, while the Cd/Br2 cell is rechargeable with an open-circuit voltage of 2.0 V, and extended temperature range of operation, and potential for high specific energy.

11591 **(CONF-871194—1) Laboratory evaluation and analysis of advanced lead-acid load-leveling batteries.** Miller, J.F.; Mulcahey, T.P.; Christianson, C.C.; Marr, J.J.; Smaga, J.A. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002851/JAW.

From International conference on batteries for utility energy storage; West Berlin, F.R. Germany (8 Nov 1987).

Argonne National Laboratory has conducted an extensive evaluation of advanced lead-acid batteries developed by the Exide Corporation for load-leveling applications. This paper presents the results of performance and accelerated life tests conducted on these batteries over a five-year period. This paper describes the operational reliability and maintenance requirements for this technology, and also includes analyses of the batteries' thermal characteristics, arsine/stibine emission rates, and cell degradation modes as determined from post-test examinations.

11592 **(EUR—10959) Anglo-Danish Advanced Battery Project: Final report.** Hooper, A.; North, J.M.; Taylor, R.I.; Daniels, L.C.; Horsley, G.; Oliver, M.R.; Hawkins, A.J. (UKAEA Atomic Energy Research Establishment, Harwell). 1987. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88900227/JAW.

A number of aspects relevant to the scale-up of all-solid-state, polymeric electrolyte, rechargeable lithium batteries have been studied. A nominal 1.7 Ah cell has been fabricated and cycled at 120°C. At the 17 hour discharge rate, the initial cathode utilization, between voltage limits of 2.0 and 2.9 volts, is ~70% theoretical, falling to 20% after 50 cycles. The controlled production of the cathode material, V_6O_{13}, has been studied in detail. One-half kg batches of pure material have been produced using a technique which may be utilized on an industrial scale. Thermal modelling studies have provided useful information regarding the potential thermal behavior of cells. Small internally generated temperature rises are predicted for cells operating at rates consistent with vehicle traction applications. The effect of cell size and the role of inter-cell connectors have been evaluated in specific cases. Work to date indicates the importance of the particular duty or driving cycle in determining the effective thermal behavior of cells and batteries. 10 figs., 5 tabs.

11593 **(N—88-10132) Effect of NASA advanced designs on thermal behavior of Ni-H_2.** Gonzalez-Sanabria, O.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. 16p. (NASA-TM—100197; E—3790; NAS—1.15:100197; CONF-871113—). NTIS, PC A03/MF A01.

From American Institute of Chemical Engineers annual meeting; New York, NY, USA (15 Nov 1987).

As part of an overall effort to advance the technology of nickel-hydrogen batteries for low Earth orbit (LEO) applications, advanced designs for individual pressure vessel (IPV) nickel-hydrogen cells have been conceived. These designs incorporate alternative methods of oxygen recombination which affect the thermal behavior of the cells. The effect of these oxygen recombination methods on the cell temperature profiles is examined.

11594 **(N—88-11021) 1986 Goddard Space Flight Center Battery Workshop.** Morrow, G.W.; Yi, T.Y. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Sep 1987. 374p. (NASA-CP—2486; REPT—87B0408; NAS—1.55:2486; CONF-861168—). NTIS, PC A16/MF A01.

From NASA battery workshop; Greenbelt, MD, USA (18 Nov 1986).

The subjects covered include: lithium cell technology and safety improvements; nickel-cadmium separator and electrode technology along with associated modifications; flight experience and life testing of nickel-cadmium cell; and nickel-hydrogen applications and technology.

11595 **(NEDOJ—501, pp 812-831) Development of new type battery energy storage system.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

To develop an electric power storage system with load levelling ability to store surplus electricity during off-peak periods by electrochemical reaction in a large capacity battery system, batteries of sodium-sulfar, zinc-chlorine, zinc-bromine, and redox-flow type are planned to be develped. System technology for connecting them to actual power systems for operation are to be developed, and the integrated power storage system is to be trially demonstrated to determine their practicability. To achieve the objective, following activities were carried out in the research and development for each type of the batteries: (1) Development of optimization technology for the battery. (2) Development of module structure technology. (3) Development of operation control and safety technology. (4) Technological research for large capacities. (5) Design, trial production, experiments. As regards the research and development of system technology, test items, methods, schedules, etc. for the test of 1 MW class lead storage battery composed of the sample storage batteries were studied. (8 figs, 5 tabs)

29 ENERGY PLANNING AND POLICY

11596 **(SEEC—28) Energy policy and industrial fuel consumption.** Read, J. (Surrey Univ., Guildford (UK) . Energy Economics Centre). May 1986. 24p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The developments in energy pricing policy in the recent past are reviewed, and the implications for increasing the conservation effort and influencing consumers' fuel choice are considered. However, all of these issues need to be considered within the context of energy policy as a whole. Constraints to energy conservation in industry, fuel switching policies and the decline in industrial energy consumption are discussed.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 10857, 11655, 11692

11597 **(NP—8750998) End user investment strategies aiming at the minimization of the cost of space heating. A microeconomic analysis with building construction in the city of Vienna serving as a representative example.** Infanger, G. (Technische Univ., Vienna (Austria). Inst. fuer Energiewirtschaft). Jun 1986. 176p. (In German). NTIS (US Sales Only), PC A09. Order Number DE88750998/JAW.

The study deals with energy demands as they are relevant to space heating. Based on microeconomic considerations the author analyzes the individual decisions of users as regards the adaption of duel demands to changed economic conditions by investing in energy conservation measures. Due to the fact that the different

measures are competing, analyses are of the simultaneous and model kind taking into account the different technical marginal conditions. The analytical procedure results in a non-linear optimization problem characterized by non-convex marginal conditions. The problem is developed and solved. Based on empirical data on the structure of buildings, heating systems and climates, optimal investments and the energy conservation they result in are calculated for different technical and economic parameters. Further analyses are dedicated to the effects of different specific policies. After aggregating the results obtained the study determines the energy conservation potentials and elasticities of the city of Vienna which serves as a representative example of densely populated areas.

11598 **(NP—8751228) Thailand - energy situation 1985.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jun 1987. 25p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751228/JAW.

The energy situation of Thailand is reviewed on the basis of relevant data. Data on general trends on the energy sector are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments.

11599 **(PB—88-110028/XAB) Source book for energy auditors. Volume 2.** Lyberg, M.D. (Florida Dept. of Transportation, Tallahassee (USA)). Apr 1987. 371p. (D—11:1987-VOL-2). NTIS, PC E13/MF A01.

See also Volume 1, PB—88-110010; Report on Energy Conservation in Buildings and Community Systems Programme, Annex XI: Energy Auditing.

The volume is comprised of appendices dealing with audit procedures, measurement techniques, analysis techniques, reference values.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 10799, 10942, 10972, 11007, 11053, 11156, 11179, 11180, 11597, 11622, 11633, 11643, 11645, 11647, 11648, 11706, 12597, 13777, 13778, 13779, 13780, 13781, 13782, 13783, 13784, 13785, 13786, 13787, 13788, 13789, 13790, 13791, 13792, 13793, 13794, 13795, 13796, 13797, 13798, 13799, 13800, 13801, 13802, 13803, 13804, 13805

11600 **(AEMA—87) Energy service companies: a resource directory.** (Association of Energy Management Analysts (Ontario), Inc., Kitchener (Canada)). 1987. 403p. Association of Energy Management Analysts, PO Box 2246, Postal Station B, Kitchener, Ont., Canada N2H 6M2; $50.00 CAN.

As a co-operative venture between the Association of Energy Management Analysts Inc., and the Canadian or Canada based energy service companies (ESCOs), the Association developed this directory. During the early part of 1986, the Association recognized a need for a one source information document outlining services, approach, expertise, and successful projects of energy service companies in Canada. To achieve this goal, the Association formed a subcommittee, having representation from Energy, Mines & Resources Canada, Ontario Ministry of Energy, and experienced municipal energy analysts. The ESCO Subcommittee in turn developed a survey criteria to obtain written submissions from energy service companies addressing questions of particular interest to potential customers. The data obtained from the survey was the basis of this directory. An update is planned to ensure the inclusion of additional ESCOs.

11601 **(DOE/PE—0077) The Windfall Profit Tax: A Department of Energy analysis.** (USDOE Office of Policy, Planning and Analysis, Washington, DC). Oct 1987. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002806/JAW.

The Windfall Profit Tax (WPT) was enacted in 1980 at the same time as the enactment of phased decontrol of domestic oil prices. Average prices for domestic oil in 1980 under the price control system were about $24 per barrel, whereas world market prices were about $34 per barrel. Oil prices were expected to rise at rapid rates following decontrol. The tax was intended to collect the "windfall" that would accrue to oil producers when the price of oil was deregulated and allowed to move to the higher world market price. Contrary to expectations, oil prices fell rather than increased. The Windfall Profit Tax was expected to collect large amounts of money and, in fact, did bring in revenues of more than $25 billion during the peak year of 1981. Although oil prices had been expected to rise in subsequent years, they declined sharply. "Windfall profits," as measured by the tax, disappeared in 1986, and WPT liabilities have been virtually zero since then. Nevertheless, continuing reporting requirements under the Windfall Profit Tax still impose a heavy cost burden on the oil industry. The American Petroleum Institute estimates that the industry's paperwork costs are about $100 million per year. The paperwork burden of the WPT is particularly onerous now because of the severe price collapse in 1986, which has threatened the ability of many oil-producing firms to stay in business. The Windfall Profit Tax also imposes a significant paperwork burden on the federal government. The WPT is counter-productive. The lower oil prices prevailing today make it unlikely that the tax will produce any significant revenues, but the compliance costs and the paperwork burdens remain. In addition, the tax serves as a deterrent to added investment and may reduce US oil production. Repeal of the WPT now would improve the oil investment climate and would help slow declining oil production.

11602 **(INA/NOGAP—8705) NOGAP bulletin 1987/1988. Annual review of NOGAP projects.** (Department of Indian and Northern Affairs, Yukon (Canada). Northern Oil and Gas Action Program). May 1987. 30p. (MICROLOG—87-05032). NOGAP Secretariat, Constitutional Development and Strategic Planning Branch, Indian and Northern Affairs Canada, Les Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report is the third annual review of Northern Oil and Gas Action Program (NOGAP) projects, updating the second bulletin issued in May 1986. It provides a brief description of NOGAP-funded projects to be started or continued during 1987/1988. One of NOGAP's operating objectives is to make its activities widely known. This volume is issued in support of this objective. It was compiled by the NOGAP Secretariat, Indian and Northern Affairs Canada with the assistance of the Federal-Territorial Relations Division, Northern Affairs Program, DIAND.

11603 **(ISI-B—18-85) Product structure change and technical progress as decisive parameters of specific energy consumption in energy intensive branches of industry.** Garnreiter, F.; Eimer, G.; Jochem, E.; Schoen, M.; Poppke, H.; Tegtmeier, H. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung). Nov 1985. 195p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751241/JAW.

The main aim of the investigation is to assess the contributions of structural and technological effects on the reduction of energy consumption (differentiated according to fuels and electricity) in the period 1968 to 1983 for the four branches of the industry concerned, i.e. mining and processing rock and soil, iron industry, non-ferrous metals industry and chemical industry, and to estimate the future specific final energy consumption up to 1990. These four most important industrial energy users used a proportion of 63% of total fuel consumption and 56% of electricity consumption in 1983, but only employed 14% of the employees in the industries concerned. Finally, there is a summary of the results covering all fields.

11604 **(NP—8751252) Industrial policy: Conception and reality.** Rahmeyer, F. (Augsburg Univ. (Germany, F.R.). Inst. fuer Volkswirtschaftslehre). Jan 1986. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751252/JAW.

The topic of this article is to confront political conception and reality of industrial policy in the Federal Republic of Germany. The latter is analyzed by means of case studies (coal industry, steel industry, R and D policy). Additionally, the Federal Government's

subsidies are investigated with regard to their goals. At the whole, the case studies do not yield a uniform, but a more concrete picture of industrial policy as in the case of an abstract discussion of its pros and cons in a social market economy. Also, the economic policy agents' ability to learn in the different fields of industrial policy is shown.

11605 Impact of tax reform on renewable energy and cogeneration projects. Kahn, E.; Goldman, C.A. (Lawrence Berkeley Lab., CA, USA). *Energy Economics;* 9: No. 4, 215-226(Oct 1987).

The sensitivity of renewable energy and cogeneration project returns to proposed changes in the federal tax code, specifically to reforms proposed in 1985 by President Reagan are examined. Six different technologies e.g. cogeneration, geothermal etc., are investigated by defining typical configurations. Project cash flows are projected over a twelve year horizon, and the investor's internal rate of return (IRR) is calculated. Changes in IRR are calculated as various proposed tax changes are assumed to take effect. Capital intensive projects, such as geothermal and small hydro, are found to suffer most from proposed tax code changes. Conversely, the least capital intensive projects, co-generation, fare best.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 10747, 10773, 10802, 10811, 10863, 10864, 10906, 10961, 10967, 10971, 10981, 11004, 11008, 11015, 11045, 11549, 11559, 11560, 11563, 11564, 11566, 11628, 11756, 11757, 11762, 12044, 12412, 12413, 12426, 12427, 12428, 12429, 12430, 12459, 12466, 12467, 12471, 12473, 12501, 12502, 12503, 12504, 12521, 12526, 12527, 12528, 12529, 12530, 12531, 12532, 12533, 12534, 12535, 12539, 12540, 12551, 12555, 12556, 12557, 12558, 12561, 12563, 12583, 12584, 12585, 12587, 12588, 12589, 12590, 12591, 12592, 12593, 12594, 12595, 12596, 12597, 12598, 12599, 12600, 12601, 12602, 12640, 12643, 12678, 12681, 12682, 12711, 13866

11606 (AE/RM—AOSERP/134) Alberta Oil Sands Environmental Research Program review for the fiscal year 1984/1985. Watson, C.E. (ed.). (Alberta Energy, Edmonton (Canada). Research Management Div.). 1987. 31p. (MICROLOG—87-05035). Alberta Environment, Research Management Division, Publications Office, 14th. Floor, Standard Life Centre, 10405 Jasper Ave., Edmonton, Alta., Canada T5J 3N4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Alberta Oil Sands Environmental Research Program (AOSERP) was designed to investigate the potential environmental effects of the intensive development planned for the Athabasca Oil Sands region in northeastern Alberta. This report describes the major research activities of AOSERP during the 1984/85 fiscal year. The research conducted under the program reflects Alberta Environment's interest in incorporating knowledge about environmental problems into sound and informed policy decisions about the recovery of Alberta's oil sands reserves. The report is divided into three sections, each addressing a major research area: environmental effects of atmospheric emissions, environmental consequences of in-situ extraction technologies, and land reclamation.

11607 (ANL/EES-TM—338) An analysis of the Sikorski bill, H.R. 4567, to control acid rain. Veselka, T.D.; Hanson, D.A.; Hemphill, R.C.; Hoffstetter, C.A.; South, D.W.; Streets, D.G. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003447/JAW.

An acid rain control bill, H.R.4567, was introduced to the 99th Congress by Rep. Sikorski on April 10, 1986, and reported out of the House Subcommittee on Health and the Environment in amended form on May 20, 1986. The bill never reached a debate in full committee, however. The bill consists of a two-phase program to limit utility sulfur dioxide (SO_2) emissions. Emissions of nitrogen oxides (NO/sub x/) and emissions from industrial boilers, industrial processes, and transportation sources would also be reduced. It is estimated that Phase I would reduce utility SO_2 emissions by 2.6 x 10^6 tons/yr by 1993, relative to the base-case forecast for that year. Phase II would reduce utility SO_2 emissions by 6.1 x 10^6 tons/yr by 1997. The approximate costs are $0.7 x 10^9/yr for Phase I and $2.2 x 10^9/yr for Phase II. These cost estimates are compared with similar estimates made by ICF Incorporated for the US Environmental Protection Agency. The Sikorski bill is estimated to also achieve a reduction in utility NO/sub x/ emissions of about 1.3 x 10^6 tons/yr at a cost of $400 x 10^6/yr. In general, state-level electricity rates are not expected to increase by more than 6 to 8% when pollution control costs are equally distributed (in terms of percent electricity rate increases) among residential, commercial, and industrial users. 38 refs., 8 figs., 33 tabs.

11608 (CONF-8706227—1) Risk assessment strategies for biotechnology. Travis, C.C.; Hattemer-Frey, H.A. (Oak Ridge National Lab., TN (USA); Maxima Corp., Oak Ridge, TN (USA)). 1987. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002310/JAW.

From NATO advanced research workshop meeting; Rome, Italy (6 Jun 1987).

Although the majority of people in the US believe that products of genetic engineering will benefit society, they are also concerned about potential risks associated with deliberate environmental releases of genetically altered organisms. At present, an established methodology for estimating these risks does not exist. However, given the current understanding of genetically altered organisms, development of a suitable risk assessment framework seems feasible. This paper examines the critical issues associated with developing such a framework. 28 refs.

11609 (IIUG-rep—86-10-Ed.2) Research at the International Institute for the Environment and Society 1982-1986. Simonis, U.E. (ed.). (Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). Oct 1986. 188p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751249/JAW.

The report gives a survey of the four main research points of the Institute. Project area I includes reports on the situation and the development of environmental conditions. The main work in project area II is the behaviour patterns of individuals and groups initiated by environmental loading, which are expressed by the formation of the ecological movement. A comparison of international environmental policies is the object of project area III. In the individual projects, the question whether the environmental measures are of a preventive or reactive character is especially followed up. In project area IV, the ecological orientation of different political areas is treated. The questions of the possibility of transforming energy policies into an energy saving policy and the agrarian-political space for negotiation for an ecologically compatible development of agriculture are examined. The appendix contains literature references for the research subjects.

11610 (ORNL—6405/R6) Environmental regulatory update table, November 1987. Langston, M.E.; Nikbakht, A.; Sharples, F.E. (Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003698/JAW.

This report provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

11611 (PB—88-100524/XAB) Economics and feasibility of co-composting solid waste in McHenry County. Final report. Alpert, J. (E and A Environmental Consultants, Inc., Stoughton, MA (USA)). Jul 1987. 258p. NTIS, PC A12/MF A01.

The purpose of the study was to evaluate the feasibility of composting various segments of the waste stream produced in McHenry County, IL. In particular, the study emphasized co-composting of municipal solid waste (MSW) with septage, co-composting of MSW with septage and sludge, leaf- and yard-waste composting, and composting various animal wastes. In addition to specific analysis of co-composting in McHenry, the report includes

chapters on the technical description and implementation of composting, environmental considerations of co-composting, comparisons of different proprietary systems, the economics of composting, and an analysis of compost markets.

11612 **(PB—88-101670/XAB) United States Environmental Protection Agency research initiatives in waste reduction for small-quantity hazardous-waste generators.** McComas, C.A.; Bridges, J.S. (Minnesota Univ., Minneapolis (USA)). Sep 1987. 12p. NTIS, PC A03/MF A01.

The US EPA Office of Research and Development is supporting a Small-Quantity Generator Research Program to develop and promote the use of innovative technologies and management practices to reduce the generation of hazardous waste. The program was established in response to the needs of small-quantity generators in the areas of waste management, regulatory compliance, and technical resources. Waste reduction is seen as a key in helping small businesses by reducing liability, product costs, disposal costs, and environmental, safety and health concerns. To date, a total of three efforts are on-going under the program with the State of North Carolina, the State of Minnesota, and the Governmental Refuse Collection and Disposal Association (CRDCA). Results from each of the three research efforts will be used to assist small businesses work toward waste reduction, improve waste management, and achieve regulatory compliance.

11613 **(PB—88-103049/XAB) Prospective epidemiological study of enteric-disease transmission associated with sprinkler irrigation with waste water: an overview.** Shuval, H.I.; Wax, Y.; Yekutiel, P.; Fattal, B. (Hebrew Univ., Jerusalem (Israel). Hadassah Medical School). Sep 1987. 28p. NTIS, PC A03/MF A01.

This report deals with a prospective epidemiological morbidity and serology study, in which the quality of data could be optimally controlled on the possible association between enteric disease incidence and waste water utilization in agricultural settlements in Israel. The study relates to wastewater contact workers and their nuclear families, i.e. their children and spouses, and to the general population exposed to the aerosols formed by sprinkler irrigation with treated wastewater. The report describes the association between enteric-disease morbidity and wastewater utilization, mainly by aerosolized wastewater by sprinkler irrigations.

11614 **(PB—88-106133/XAB) Superfund.** Hill, R.D. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Sep 1987. 31p. (EPA—600/D-87/293). NTIS, PC A03/MF A01.

This chapter covers the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and its amendments. CERCLA is a very comprehensive law, directing the USEPA, other Federal agencies, and the states on how to collect and manage the fund, conduct cleanups, encourage private cleanups, and recover the costs of Federally-supported actions. The 1980 legislation established a fairly straightforward structure to obtain these goals. The 1986 amendments did not fundamentally alter the structure, but added far more detail than was present in the original law and added some additional requirements and provisions. The procedures for placing a site on the National Priority List, conducting preliminary assessment, removal action, remedial investigations, and feasibility studies are discussed.

11615 **(PB—88-107529/XAB) Superfund remedial design and remedial action guidance (revised).** (Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response). Jun 1986. 105p. (OSWER-DIRECTIVE—9355.0-4A). NTIS, PC A06/MF A01.

Revision of report dated Feb 1985.

This guidance document has been developed to assist agencies and parties who plan, administer, and manage remedial design (RD) and remedial action (RA) at Superfund sites. The document was developed primarily for use by remedial project managers, state project officers, U.S. Army Corps of Engineers personnel, and responsible parties. The document is organized to reflect the general sequence of events that occurs prior to, during, and after remedial design and remedial action at a Superfund site.

11616 **(PB—88-109822/XAB) Fire tests on insulation for aluminum tank cars: an evaluation of glass-fiber, ceramic-fiber, and mineral-fiber materials in torch-fire and pool-fire environments. Final report.** Larson, W.G. (Association of American Railroads, Pueblo, CO. Transportation Test Center). Aug 1987. 34p. (REPT—86-121). NTIS, PC A03/MF A01.

Tests were conducted at the Transportation Test Center to determine the vulnerability to fire of aluminum tank cars designed to transport hazardous materials under pressure when the aluminum was protected by three types of insulation. Glass, mineral, and ceramic fiber blankets, each covering a speciment of aluminum plate commonly used in tank car construction, were subjected to standard torch-fire and pool-fire tests while instrumentation recorded the rise in temperature of the aluminum plate. The data derived from the tests will be used by the FRA to build the information base required for an examination of the vulnerability of aluminum tank cars to both mechanical and thermal accidents. The report presents details of the 20 tests performed by the Research & Test Department of the Association of American Railroads. It compares the thermal-protective qualities of the three individual types of insulation covering the aluminum and includes a comparative test series on bare aluminum plate.

11617 **(PB—88-114053/XAB) Multi-media compliance audit procedures.** (National Enforcement Investigations Center, Denver, CO (USA)). Jun 1987. 212p. (EPA—330/9-87/001-R). NTIS, PC A10/MF A01.

This manual is intended as a guide for investigators who conduct multi-media compliance audits of facilities that discharge, emit, prepare, manage, store, or dispose of pollutants controlled by federal, state, or local environmental laws and regulations. Investigative methods are presented that integrate the enforcement programs associated with air, water, solid waste, pesticides, and toxic substances. Investigators performing compliance audits follow established policies and procedures for: (1) chain-of-custody and document control; (2) handling of confidential enformation; (3) employee conduct; (4) quality assurance and quality control; and, (5) safety rules.

11618 **(PB—88-114301/XAB) Regulating chemical hazards in Japan, West Germany, France, the United Kingdom, and the European community: a comparative examination. Final report.** Coppock, R. (National Research Council, Washington, DC (USA). Commission on Life Sciences). 1986. 109p. NTIS, PC A06/MF A01.

This report is an outgrowth of a National Research Council program initiative to gain a cross-national perspective on the role scientific information has played in hazardous chemical regulation. Although this study is not meant to be evaluative, it is designed to help assess by comparison the decision-making and regulatory mechanisms in U.S. hazard assessment. The chapters on the individual countries are divided into three components: (1) relevant political and administrative traditions that influence expectations about and mechanisms of hazard regulation; (2) a compilation of the relevant statuatory instruments; and (3) the scope of the regulatory jurisdiction. The last category divides the laws into those which govern industrial plants, emmissions and discharges, worker protection, industrial substances, poisons, agricultural chemicals, food additives, and contaminants, consumer products, transport, chemical waste, and victim compensation. The study concludes with a discussion of ways in which such multinational perspectives might be used to strengthen the regulatory process of the U.S.

11619 **(PB—88-115126/XAB) Cost of lead-based-paint abatement in public housing. Volume 1.** Wallace, J.E. (Abt Associates, Inc., Cambridge, MA (USA)). Jul 1986. 87p. NTIS, PC A05/MF A01.

See Also Volume 2, PB—88-115134.

This study provides data on lead incidence and the estimated costs of abating lead hazards in public housing at several possible threshold levels of lead concentration in applied paint. The data were collected at a sample of family projects by cooperating Lead Paint Poisoning Prevention Programs using data collection forms designed for the study. National estimates are provided based on

the assumption that the construction year of a dwelling or building is the only characteristic related to lead incidence. The estimates are provided for all family dwelling units, defined as those of two-bedrooms or larger; for all buildings in family projects; and for site-wide facilities in family projects.

11620 **(PB—88-115134/XAB) Cost of lead-based-paint abatement in public housing. Volume 2. Appendix C-F.** (Abt Associates, Inc., Cambridge, MA (USA)). Jul 1986. 142p. NTIS, PC A07/MF A01.

See also Volume 1, PB—88-115126.

This study provides data on lead incidence and the estimated costs of abating lead hazards in public housing at several possible threshold levels of lead concentration in applied paint. The data were collected at a sample of family projects by cooperating Lead Paint Poisoning Prevention Programs using data collection forms designed for the study. National estimates are provided based on the assumption that the construction year of a dwelling or building is the only characteristic related to lead incidence. The estimates are provided for all family dwelling units, defined as those of two-bedrooms or larger; for all buildings in family projects; and for site-wide facilities in family projects.

11621 **(PB—88-122395/XAB) Resource Conservation Recovery Act notification data file. Data file.** Levy, S.; Murray, P.; Sprow, W. (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). 30 Sep 1987. mag tap. NTISCP T04.

Supersedes PB—87-169272; Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

This file contains data compiled for the Resource Conservation Recovery Act. Notification of Hazardous Waste Activity, EPA form 8700-12 was used to collect the data. The file was updated with information compiled from the Application for a Hazardous Waste Permit - EPA Form 3510-3. The data include names and addresses of the facility owner and operator, as well as the facility contact name and phone number. The data indicate whether a facility is a generator, treatment/stoves/disposer, and/or transporter of hazardous waste. There is also a listing of code numbers of waste handled, taken from 40 CFR Part 26.

11622 **(PB—88-122999/XAB) EPA's (Environmental Protection Agency's) use of benefit-cost analysis: 1981-1986.** Clark, L.H. (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). Aug 1987. 118p. (EPA—230/05-87/028). NTIS, PC A06/MF A01.

See also report dated Apr 84, PB—84-181601.

Contents include: historical background; legislative authorities affecting benefit-cost analysis; EPA's benefit-cost analyses: 1981-1986; contributions of benefit-cost analysis; limitations of benefit-cost analysis; directions for the future.

11623 **(PB—88-127048/XAB) Unfinished business: a comparative assessment of environmental problems: overview report.** (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). Feb 1987. 122p. (EPA—230/2-87/025A). NTIS, PC A06/MF A01.

See also Appendix 1, PB—88-127055; Also available in set of 5 reports PC E99, PB—88-127030.

Since 1970 the Nation has done much to abate the most visible forms of pollution, but there is still much unfinished business. New problems have also been discovered or have risen in importance. Many of these new problems are difficult to evaluate; many involve toxic chemicals that can cause cancer or birth defects at levels of exposure that are hard to detect; and many involve persistent contaminants that can move from one environment medium to another, causing further damage even after controls have been applied for one medium. The complexity and gravity of these issues make it particularly important that EPA apply its finite resources where they will have the greatest effect. Thus, the Administrator of EPA commissioned a special task force of senior career managers and technical experts to assist him and other policy makers in the task. The assignment was to compare the risks currently associated with major environmental problems. In conducting the project, the universe of environmental problems was divided into 31 pieces. Four different types of risks were considered for each problem area. Each risk was analyzed and the findings published in separate volumes as: Appendix I - Report of the Cancer Risk Work Group; Appendix II - Non-Cancer Risk Work Group; Appendix III - Ecological Risk Work Group; Appendix IV - Welfare Risk Work Group.

2904 Natural Resources

REFER ALSO TO CITATION(S) 11204, 11621, 12503, 12557, 12583, 12584, 12585

11624 **(PB—88-113683/XAB) International role of US geoscience. Final report.** (National Research Council, Washington, DC (USA)). Jun 1987. 104p. NTIS, PC A06/MF A01.

Geologic processes are global in scope and no country or continent has good areas for studying all the phenomena. Joint participation between U.S. and foreign scientists is indispensable for the advancement of basic scientific concepts and their application to economic and policy issues in the U.S. Up-to-date knowledge is critical to assure an adequate flow of industrial minerals and to assure an adequate supply of strategic minerals.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 10828, 11180, 11600, 11602, 11609, 11641, 12271, 12503, 13775, 13776, 13779, 13785, 13786, 13788, 13791, 13792, 13803, 13804, 13805

11625 **(ETSU-R—43) Background papers relevant to the 1986 appraisal of UK energy research, development and demonstration.** (UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). Feb 1987. 576p. H.M. Stationery Office, London, price Pound 35.

A report is given which complements the 1986 Appraisal of UK Energy Research Development and Demonstration. It contains detailed technical modules on the sixty-one technologies covering the extraction of energy, electricity production, energy supply, energy conversion and energy utilization. For each of the technologies, an assessment is made of the technical status and economic prospects before evaluating the cost effectiveness of the associated RD and D programmes.

11626 **(PB—88-138169/XAB) Indo-US Science and Technology Subcommission: cooperation in materials science.** (Indo-U.S. Subcommission on Science and Technology, Washington, DC). 1987. 21p. NTIS, PC E03/MF A01.

The Indo-U.S. materials science program is directed toward solving problems of critical importance to both countries in the highly sophisticated areas of quasicrystal phases, advanced ceramics, corrosion, tribology, hydrodynamics, laser spectroscopy, optical fibers, integrated circuits, and semiconducting materials. The program, with an investment of some $3 million, involves the participation of some of the most important institutions in both countries in its 11 major programs and 26 subprojects. Under the program's extensive exchange of scientists, several Indian scientists are now in the United States, and more are scheduled to visit. The report describes the various research projects; it does not include results or data.

11627 **(SECV-GO—86/103) [State Electricity Commission of Victoria]. Annual report 1985-1986.** (State Electricity Commission of Victoria, Melbourne (Australia). Research and Development Dept.). Dec 1986. 81p. State Electricity Commission of Victoria, Melbourne (Australia). Research and Development Department.

This annual report includes a variety of information on the Research and Development Department of Coal Science at the State Electricity Commission of Victoria. The report includes information on the management, personnel and general staffing, the 1986

technical programs - the highlights in the power generation, environment and development fields plus a description of service work and investigative chemical services is given.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 10962, 10967, 10971, 10972, 10981, 11004, 11015, 11042, 11479, 12044, 12521, 12678, 12681, 12682

11628 (DOE/OR/00033—T377) CIRRPC [Committee on Interagency Radiation Research and Policy Coordination] member agency participation in international radiation activities. (Oak Ridge Associated Universities, Inc., TN (USA)). May 1987. Contract AC05-76OR00033. 48p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003356/JAW.

The member agencies of the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) have considered what role the Committee might play in assuring that US participation in international organizations is consistent with US radiation policy and in encouraging cooperation in research and information exchange. The Executive Committee agreed that a first step in addressing such a potential involvement would be to compile certain basic information on the Federal government's present participation in international programs. Each of the CIRRPC member agencies has provided information on points of contact within the agency having liaison with international organizations and having an interest in radiation matters, staff attendance at international meetings on radiation matters, and a listing of international organizations which routinely invite agency representatives to participate in such meetings. This report is composed of information obtained from the CIRRPC member agencies.

11629 (IFE/KR/E—87/003) Nuclear power - status and development 1986/1987. Lingjaerde, R.O. (Institute for Energy Technology, Kjeller (Norway)). Oct 1987. 20p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751470/JAW.

A review og the present global position of nuclear power is given. Topics as nuclear power in developing countries, operation experience for the Super Phenix reactor, and the long-term consequences of the Chernobyl reactor accident are briefly dealt with.

11630 (INIS-mf—11078) Czechoslovak state and sector standards relating to peaceful uses of nuclear energy. Annotated cataloguing records. Brabec, D. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). Oct 1986. 139p. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88700820/JAW.

Normalizace v jaderne technice.; No. 3.

An annotated bibliography is presented of Czechoslovak state standards and sector standards valid in nuclear power generation, nuclear power engineering, nuclear technology, nuclear instrumentation, uses of ionizing radiation and radionuclides, and the metrology of ionizing radiation. The bibliography shows the state of standards in these fields at August 31, 1986 and contains 128 entries in such form which allows them to be cut out and used as catalogue cards. The bibliography is supplemented with a numerical list of CMEA standards in nuclear fields with reference to the numbers of the corresponding Czechoslovak standards, and an informative list of Czechoslovak standards which are being prepared but have as yet not been issued. (A.K.).

11631 (NUREG—0090-Vol.10-No.1) Report to Congress on abnormal occurrences: [Quarterly report], January-March 1987. (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Oct 1987. 52p. NTIS, PC A04/MF A01 - GPO. Order Number TI88900142/JAW.

The Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from January 1 to March 31, 1987. The report states that for this reporting period, there was one abnormal occurrence at the nuclear power plants licensed to operate. The item involved the NRC suspension of power operations of the Peach Bottom Facility due to inattentiveness of the control room staff. There were seven abnormal occurrences at the other NRC licensees. Four involved diagnostic medical misadministrations; the other three involved breakdowns in management controls at three separate industrial radiography licensees. There were two abnormal occurrences reported by the Agreement States. Both involved breakdowns in management controls at industrial radiography licensees. The report also contains information updating some previously reported abnormal occurrences. Appendix A contains the criteria used to define an abnormal occurrence. 13 refs.

11632 (ORNL/Sub—86-55972/1) Commercial nuclear power and the national interest. Ebinger, C.K.; Brown, R.J.; Cooper, R.C.; Mills, M. (Georgetown Univ., Washington, DC (USA). Center for Strategic and International Studies). Aug 1987. Contract AC05-84OR21400. 79p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE88003697/JAW.

The US is becoming increasingly dependent on imported oil. By the mid-1990s imports are likely to reach 11 million barrels per day, almost twice the current level of 6 million barrels per day. A major share of these imports is likely to be coming from insecure Middle East sources. When this situation materializes, the US will find itself more vulnerable to economic disruption than in any prior period in its history. The consequences are ominous. Ironically, a significant component (nearly half) of this increase in oil import dependency will be attributable to the electric utility sector. This is ironic because there are clear alternatives to oil use in the electricity sector. These alternatives, coal and nuclear power, have serious institutional, financial, and regulatory problems which are preventing their use for future electric generation requirements. For reasons of national security, the resolution of these problems should be made a matter of national priority. The policy choices before the United States are stark. Either we take the actions necessary to fully utilize all of our domestic energy resources, including nuclear power, while we continue to take measures necessary to secure access to our vital foreign oil supplies; or we remain at the mercy of parochial interests and risk losing control of our economic, political and strategic destiny.

11633 The fairness hypothesis and managing the risks of societal technology choices. Cantor, R.; Rayner, S. New York, NY; American Society of Mechanical Engineers (1987). 6p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/TS-5.

Much of the literature on risk perception and management published over the last few years has asked how society should resolve the question, "How safe is safe enough?" This paper argues that, from a societal risk-management perspective, we should be addressing a different range of questions that views societal risk as a whole rather than as the sum of individual hazards. Resolving the question, "How safe is safe enough?" is less important in making societal technology choices than "How fair is safe enough?" A recent empirical pilot study is reported which explored the fairness hypothesis in the context of nuclear power. The results indicate that the process of technology choice should recognize explicitly the preferred principles different parties hold with respect to obtaining consent from those affected by the risks, distributing the liabilities, and justifying trust in the relevant institutions. The paper closes with a discussion of future prospects for the fairness approach to areas such as noxious facility siting.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 10873, 11583, 11646

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 11396, 11605, 11746

11634 (CEA-CONF—9019) District heating and seasonal storage in confined aquifer at Plaisir. Despois, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Mar 1987. 16p. (CONF-8703226—1). NTIS (US Sales Only), PC A03. Order Number DE88751707/JAW.

From Franco-Japanese seminar on energy management in industry; Paris, France (24 Mar 1987).

A system for big sized storage of heat between seasons has been studied for more than 10 years by a french petroleum group - the ELF-AQUITAINE National Cy - and the Atomic Energy Commissariat, with the financial assistance of the Agence Francaise pour la Maitrise de l'energie and the European Economic Community. The storage process is using a deep confined aquifer consisting of a porous sand layer filled with water under pressure and which is limited, at top and bottom, by two impermeable levels. In such a layer, it is easy to keep water as a liquid at a temperature higher than 100/sup O/C. Nevertheless, underground chemical reactions and pressures at the surface become too large above 180/sup O/C, which can be considered as a limit-temperature. This project may be divided in 3 parts: 1 - Equipment of a household waste incineration plant for heat recovery. The amount of burnt wastes is about 110,000 tons/year, giving 100 heat-Gwh/year. 2 - Coupling of this plant with several unit of block-heating (about 5000 apartments and several public facilities) 3 - Building, testing and coupling of the storage unit, using a 500 metre deep captive aquifer under a 45 bar pressure.

2910 Conservation

REFER ALSO TO CITATION(S) 10857, 11603, 11641, 11689, 11692, 11694, 11696, 11698, 11705, 11706, 11725, 11733, 11740

11635 Energy conservation policies in the OECD. Did they make a difference. Schipper, L. (Lawrence Berkeley Lab., CA, USA). *Energy Policy;* **15**: No. 6, 538-548(Dec 1987).

In 1985, homes, services, automobiles, truck freight, air passenger traffic, other transport, and manufacturing in the OECD used 47 million bbl/day of oil equivalent (mb/doe), or 105 000 PJ. Between 1972 and 1985, however, energy use per unit of activity in each of these sectors in the OECD fell significantly. If these energy intensities, by sector, had been frozen at their 1972 values, 1985 end-use would have been close to 64 mb/doe, or 143 000 PJ, at the rates of activity that prevailed in each sector in 1985. The difference yields a saving of 17 mb/doe. The corresponding oil savings in this period amount to close to 12 mb/doe, including substitution by other fuels. It is suggested that most of these savings will not reverse in the near time with lower oil prices as only a small part was caused by energy conservation policies.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 10769, 11204, 11596, 11632, 11633, 11644, 11650, 11652, 11655, 11697, 11700, 11730

11636 (OIES-EE—1) Demand for energy by U.K. manufacturing industry. Lynk, E.L. (Oxford Institute for Energy Studies (UK)). 1985. 27p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The question of the degree to which industrial consumers respond to fluctuations in the relative prices of energy and non-energy inputs has received considerable attention in recent years. Until the first major oil price shock of 1973/74 attention had focussed primarily on capital-labour substitutability, and the effect this has had in the determination of income shares and economic growth. In the past energy was not seen as a potential constraint to future growth, and was generally excluded from analyses of factor substitution and distribution. Along with raw materials it was regarded as a separable input which could be ignored in growth forecasting and macro-economic projections. The role of depletable resources in present and future production, and the influence of depletion profiles on the production and consumption possibilities of firms and individuals is seen as increasingly relevant.

11637 (PB—88-119623/XAB) Bulletin of the Electrotechnical Laboratory, Vol. 49, No. 5, 1985. (Electrotechnical Lab., Sakura, Ibaraki (Japan)). 1985. 65p. NTIS, PC E04/MF A01.

Contents include; method for processing the statistical data on demand and supply of energy; construction of a database for energy technologies data; Numerical analyses of double optical path temperature of hot gas; A highly parallel computer architecture (in English).

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 10773, 10869, 10962, 10971, 10981, 11004, 11015, 11042, 11549, 11601, 11602, 11609, 11610, 11628, 11631, 11633, 11641, 11644, 11646, 11653, 12502, 12521, 12678, 12681, 12682

11638 (DOE/OR/00033—T379) Committee on Interagency Radiation Research and Policy Coordination: Summary of CIRRPC activities for the period July 1 through September 30, 1987. (Oak Ridge Associated Universities, Inc., TN (USA)). 12 Nov 1987. Contract AC05-76OR00033. 12p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003357/JAW.

This report describes the activities of the Committee on Interagency Radiation Research and Policy Coordination for a three month period in 1987. The report briefly summarizes the efforts of the Executive Committee; the Science Panel; Policy Subpanels on Radioepidemiological Tables and Indoor Radon; Science Subpanels on Radiation Protection Standards, High LET Radiation, and Research Needs in the Effects of Non-Ionizing Radiation; Radioepidemiological Tables; Predisaster Planning, and Risk Assessment. Brief reports on special projects are included. (TEM)

11639 (ORAU—87/J-78) Committee on Interagency Radiation Research and Policy Coordination: Third annual report, July 1, 1986 to June 30, 1987. (Oak Ridge Associated Universities, Inc., TN (USA)). 30 Jun 1987. Contract AC05-76OR00033. 15p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003358/JAW.

During its third year the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) issued two reports of national importance and addressed 12 issues, six of which will be discussed in reports scheduled for issuance within the first several months of its fourth year of operation. The two reports are the report on the guidance for US policy on use of the international system of units for radiation quantities and measurements, issued in December 1986, and the report identifying the radiation exposure issues associated with the exposure to radon naturally occurring in houses and buildings, issued in August 1986. A listing of the Executive Committee members, agencies' representatives, science panel members and science and policy panel participants are contained in section IV.A. CIRRPC's reporting and organizational structure and Oak Ridge Associated Universities (ORAU) technical assistance staff is contained in section IV.B.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 10730, 10773, 10795, 10799, 10802, 10818, 10819, 10820, 10821, 10822, 10823, 10824, 10825, 10826, 10827, 10828, 10835, 10836, 10837, 10845, 10846, 10847, 10848, 10849, 10850, 10851, 10852, 10853, 10854, 10855, 10856, 10869, 10873, 10874, 10884, 10889, 10889, 10890, 10890, 10907, 10907, 11598, 11602, 11625

11640 (NP—8770032) Problems of working out a marketing system for energy sources - an analysis with special regard to the heating oil market. Gruppe, G.A. (Augsburg Univ. (Germany, F.R.). Wirtschafts- und Sozialwissenschaftliche Fakultaet). 23 Jan 1985. 253p. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770032/JAW.

In recent years energy economy has been influenced by numerous factors: There has been an increasing number of governmental regulations to be conformed to and the behaviour of users has been undergoing considerable changes both with regard to the user's general notion of consuming goods and with regard to his notion of energy consumption. Users have been continuously been reducing their energy consumption and the demand for petroleum is taking on a different structure. Apart from the factors which are directly related to energy economy strained relations have for some time been weighing heavily on the supplying company-public interest configuration. The trends described are analyzed for their possible implications concerning the trading of fossil fuels as well as the marketing of fuels and heating oils. Based on the general conditions determining the heating oil market, reference is made to the particular characteristics of heating oils and their uses as the most important member in the chain of energy supplies. The structures of the heating oil market and structure of the supplying industry reveal a number of problems which are systematically classified by functions and are analyzed for the extend and dimensions of marketing efforts required to solve them. Analysis is based on an integrative-functional marketing formulation. Apart from analyzing the present situation of fuel markets the study points out feasible ways of restructuring this branch within its heterogeneous and conglomerate framework.

11641 Issues in transferring U.S. energy technologies to developing nations. Wilbanks, T.J.; Brown, M.A.; Samuels, G. New York, NY; American Society of Mechanical Engineers (1987). 6p. (CONF-861211—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Technical Paper 86-WA/TS-9.

To stimulate discussion of potentials for and mechanisms of technology transfer from the U.S. to developing nations, this paper draws upon two bodies of experience at the Oak Ridge National Laboratory (ORNL): (1) a wide variety of technical assistance activities supported by the U.S. Agency for International Development (AID), helping AID-assisted developing nations improve their energy planning, policy formulation, and applications of fossil and renewable energy options; and (2) a wide variety of technology transfer related activities, ranging from (a) transfer assistance to buildings energy conservation programs of the U.S. Department of Energy in improving the transfer of new technologies from the nation's R and D system to commercial users to (b) research to improve the general understanding of the technology transfer process, especially from R and D institutions to commercial developers. Using three energy options of current interest to AID as examples (carbonized coal briquettes to meet residential and commercial sector energy needs, wood gasification to power stationary internal combustion engines, and rural electrification), the paper illustrates the importance of several dimensions often neglected in engineering-economic analysis, such as institutional requirements and a relatively detailed understanding of market segments. Unless such dimensions are incorporated effectively into technology transfer efforts by U.S. developers, relatively little success should be expected either in expanding markets for U.S. technology or in helping developing nations meet their energy needs.

11642 Production of onshore lower-48 oil and gas model. Trapmann, W. (Energy Information Administration, U.S. Dept. of Energy, Washington, DC). pp 343-348 of Energy markets in the longer-term: Planning under uncertainty. Kydes, A.S.; Geraghty, D.M. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-840851—).

From 2. IMACS symposium on energy modeling and simulation; Upton, NY, USA (26 Aug 1984).

This paper describes PROLOG in general terms to provide the reader with an understanding of the nature of the model. The description is followed by a discussion of the uses of the model and model limitations. The specific examples presented provide the reader with insight into sime of the issues confronting builders and users of any model. This paper discusses some common problems facing all analysts who develop or use models. These models serve important roles in support of the diverse functions of both industry and the public sector. The importance of these roles requires that the information provided is accurate and reliable. One model used by the Department of Energy is PROLOG. This description served as background for the reader to better appreciate the specific modeling issues that were confronted both in the development process and subsequent use of this particular model.

11643 An approach to the analysis of optimal investment in oil exploration and development under uncertainty. Anandalingam, G.; Mubayi, V. (Brookhaven National Lab., Upton, NY 11973). pp 335-342 of Energy markets in the longer-term: Planning under uncertainty. Kydes, A.S.; Geraghty, D.M. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-840851—).

From 2. IMACS symposium on energy modeling and simulation; Upton, NY, USA (26 Aug 1984).

A probabilistic framework for modelling the (social) profitability of investment in oil exploration has been developed in the context of investments undertaken by state petroleum enterprises in currently oil-importing developing countries. The approach is illustrated by a preliminary analysis of the investment program proposed by India's state petroleum company. In this paper the authors presented an analytic approach based on decision theoretic concepts for optimal investment planning for exploration of oil in developing countries. They provide an illustration of using their techniques using a combination of actual data for India and assumed probability distributions. Using the framework for optimal investment planning they showed that ceteris paribus, State Petroleum Enterprises in developing countries would obtain a higher probability of profitability for investment in oil exploration than multinational oil companies. Conversely, to obtain the same probability of profitability, SPE's would have a larger outlay for exploration. However, such investments are limited by social profitability considerations. The authors plan to further these concepts by investigating whether the projected investment plan of the Oil and Natural Gas Commission (ONGC) of India is greater than, equal to or less than what would be optimal from a social profitability criteria.

11644 The gas analysis modeling system (GAMS): A detailed model of the U.S. natural gas market. O'Neill, R.P.; Mariner-Volpe, B.; Trapmann, W.; Kydes, A.S.; Witzgall, C.; Mylander, W.C.; Stewart, W. pp 365-372 of Energy markets in the longer-term: Planning under uncertainty. Kydes, A.S.; Geraghty, D.M. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-840851—).

From 2. IMACS symposium on energy modeling and simulation; Upton, NY, USA (26 Aug 1984).

The Gas Analysis Modeling System (GAMS), developed by the U.S. Energy Information Administration (EIA) to analyze natural gas issues, contains detailed representations of natural gas supply, pipeline transmission, distribution, pricing, and demand. Among the model's features are separation of pipelines bidding for new reserves, which is based on projected future demand, from natural gas production, which is based on current demand. GAMS also contains explicit representations of natural gas contract provisions, including take-or-pay clauses and definite and indefinite pricing escalator provisions. GAMS now has been successfully linked to EIA's Intermediate Future Forecasting System (IFFS) which contains process models of demand as well as the capability to analyze supply, demand, and pricing for other fuels. The need to ana-

lyze the natural gas market, including alternative decontrol and pricing options and their impacts on the U.S. natural gas system, provided the main incentive for EIA to develop GAMS. The projections are also provided as a service to other branches of the Department of Energy, the Federal Government, and non-Federal public and private institutions concerned with the domestic natural gas economy.

2960 Electric Power

REFER ALSO TO CITATION(S) 11625, 11655

11645 (EMR—861001) Electricity rates in Canada handbook 1986. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1 Oct 1986. vp. (MICROLOG—87-04496). Electrical Energy Branch, Energy, Mines and Resources Canada, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Numerical data only are presented for monthly electricity costs (residential and commercial) for selected Canadian cities. Total electricity supply is broken down by province. Residential, urban and rural electricity costs are provided for selected Canadian cities. Calculations of electricity costs for commercial and residential sectors are tabulated by province. Historical data are supplied.

11646 (ERCB—D/87/14) Alberta Power Limited, Alberta - Saskatchewan Interconnection Empress area. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 30 Sep 1987. 7p. Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Alberta Power Limited applied to the Energy Resources Conservation Board to: construct and operate a direct-current, back-to-back converter station near Empress, Alberta, construct and operate designated transmission lines, interconnect designated lines with the converter station, and make alterations to the existing substation and transmission line. A public hearing was held August, 1987. The views of the applicant, interveners, and the Board are discussed in this report. The Board approved the application. Specific location of one line is subject to the location of transmission facilities in Saskatchewan to be determined before approval.

11647 (NEB-SS—8706E) The regulation of electricity exports. Report of an inquiry by a panel of the National Energy Board following a hearing in November and December, 1986. (National Energy Board, Ottawa, Ontario (Canada)). Jun 1987. 90p. (MICROLOG—87-04673). National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In September 1986, the Minister of Energy, Mines and Resources asked the National Energy Board to review and report on the changes that could be made to simplify and reduce the regulation of electricity exports. The Board now licenses exports of electricity, issues export orders, issues certificates approving the construction of international power lines, and approves the routes for those facilities. In response to the Minister's request, the Board decided to hold a public hearing to obtain the views of interested parties on the issues relating to regulation of electricity exports and international power lines. Representatives included electric utilities, governments, associations, and public interest groups. The report covers the evidentiary material compiled and the hearing panel's own views.

11648 (NEB-SS—8706F) Federal regulation of electricity import. Report concerning a hearing by a committee of the National Office of Energy before an audience November and December, 1986. (Office National de l'Energie, Ottawa, Ontario (Canada)). Jun 1986. 108p. (In French). (MICROLOG—87-04674). National Energy Board, Regulatory Support Office, 473 Alberta Street, Ottawa, Ont., Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In September 1986, the Minister of Energy, Mines and Resources asked the National Energy Board to review and report on the changes that could be made to simplify and reduce the regulation of electricity exports. The Board now licenses exports of electricity, issues export orders, issues certificates approving the construction of international power lines, and approves the routes for those facilities. In response to the Minister's request, the Board decided to hold a public hearing to obtain the views of interested parties on the issues relating to regulation of electic exports and international power lines. Representatives included electric utilities, governments, associations, and public interest groups. The report covers the evidentiary material compiled and the hearing panel's own views.

11649 (ORNL/Sub—86-56559/2) Prudence issues affecting the US Electric Utility Industry: Executive summary. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Nov 1987. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003702/JAW.

The cost impact to private utilities resulting from prudence hearings before State Public Utility (Service) Commissions is currently a matter of considerable concern to investors and the nation. Cost disallowances for many utilities threaten the economic health of the companies. The disallowances, which deny full construction cost recovery to utilities, have had a negative effect on the ordering of any new base load power plants, either nuclear or coal. They have contributed to the fact that no nuclear plants have been ordered since 1978, and none are currently being planned in the US. This situation has led to a major national concern that adequate, reliable and economic electric power may not be available to fully meet future needs of the country. The US Department of Energy is addressing the institutional, financial and regulatory problems of the nuclear power industry. This report addresses the prudence issues aspect of this program. This includes the development of a body of data depicting the causes of electric power plant cost disallowances, analysis of the causes and their impact, and the development of recommended actions that may eliminate or alleviate the negative conditions found.

11650 (PB—88-101118/XAB) Study of long-range electrical demand planning in Maryland. Final report. Jensen, K.A.; Doane, M.J.; Hartman, R.S. (Little (Arthur D.), Inc., San Francisco, CA (USA)). Jan 1987. 216p. NTIS, PC A10/MF A01.

Arthur D. Little, Inc. was commissioned by the Maryland Power Plant Research Program to undertake a study to perform a critique of current PPSP electricity sales and peak-demand forecasting methodologies; identify a possible set of alternative forecasting methods and models that could provide improved forecasting accuracy; and to recommend to the PPSP methodological improvements that would assist the PPSP in achieving its goals. The report summarizes the study.

11651 (PB—88-110598/XAB) Electric Utility Company Monthly Statement, 1986 (EIA-826). Data file. Harris-Russell, C.; Marcotte, R. (National Energy Information Center, Washington, DC (USA)). 1986. mag tap. NTISCP T02.

See also PB—86-211513, and PB—85-200384; Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Purpose of Form EIA-826 formerly FERC-5, Electric Utility Company Monthly Statement, is to collect data necessary to fulfill regulatory responsibility; identify near-term trends in energy

use; and contingency analysis. This form is filed monthly by approximately 150 electric utilities. All privately owned electric utilities with annual electric operating revenues of $100,000,000 or more must respond. In addition, the sample includes other selected electric utilities. The reported data is expanded by factors, calculated using annual data from a previous period, to give electric sales data by state and sector. Other information collected includes data gathered on depreciation, construction, net income before taxes, and extraordinary items.

11652 **(PB—88-113014/XAB) Impacts of an electric-generating-capacity shortfall. Final report.** (Data Resources, Inc., Lexington, MA (USA)). Jul 1987. 149p. NTIS, PC A07/MF A01.

To quantify the impacts of alternative electric-utility strategic-capacity-planning methodologies on the natural gas industry, this regional study analyzes two scenarios; a traditional planning environment (base case) where large efficient baseload plants meet demand, and an investment-avoidance scenario characterized by regulatory disallowance of return on investment, cancellation of long-construction-lead-time projects perceived to be at risk, and implementation of capital-minimization strategies. Both scenarios foresee a need to increase the existing 700 gigawatt (GW) electric-capacity base: by 300 GW for the base case between 1985 and 2010, and by over 500 GW in the investment-avoidance case. Combined-cycle and combustion turbine plant additions dominate the near-term outlook for both cases.

11653 **(PB—88-130000/XAB) Users guide to the project financial model. Annual report, May 1983-May 1984.** Clark, C.E.; Haas, S.M.; Regulinski, S.G.; Wilson, D.S. (Decision Focus, Inc., Los Altos, CA (USA)). Sep 1984. 66p. (DFI-TR—1336.02). NTIS, PC A04/MF A01.

The project-level interactive financial model for energy-producing plants operates in two modes: as a detailed financial model that uses detailed tax, financial, and cost data to compute year-by-year cost, and as an abbreviated model that uses simplified tax, financial, and cost data to compute levelized prices. The model is applicable to several ownership forms including investor-owned utilities, municipalities, rural electric cooperatives, and unregulated private industry. It simulates the effect of several regulatory environments such as the Federal Regulatory Commission, state-level public utility commissions, municipal or local regulation, and unregulated private industry. The document describes the model and illustrates its use, including all inputs, outputs and operating procedures.

11654 **(PM—860219) Organization structure alternatives for an independent Northwest Territories electric utility.** (Peat Marwick Ltd. (Canada)). 19 Feb 1986. 42p. (MICROLOG—87-04864). Energy, Mines, and Resources Development Secretariat, Government of the Northwest Territories, PO Box 1320, Yellowknife, N.W.T., Canada X1A 2L9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Conclusions and recommendations for the management, operation, and control of the electrical utility in the Northwest Territories (GNWT) are presented. The purpose of the project was to assess the options of a fully integrated utility, owned and operated by GNWT, in comparison to a similar ownership arrangement with operation contracted to Northland Utilities Limited (NUL). Two alternatives are evaluated and compared by nine operating requirements: mandate, employment, uninterrupted power, affordable power, quality of personnel, operating efficiency, regulation, borrowing capacity, and organizational flexibility. From this analysis, the holding company/contractor alternative is preferred. The recommendation is that GNWT enter into discussions with NUL and the parent company, Alberta Power Ltd., to obtain a Letter of Understanding for a management services contract for the utility. This is expected to provide cost-effective service to residents of the Northwest Territories.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 10795, 11603, 11632

11655 **(EPRI-EM—5126-Vol.2) Energy-use patterns and indicators: Volume 2, Data tables: Final report.** Andrews, L.M.; Heidell, J.A.; King, M.J.; Scott, S.G.; Snow, C.C. (Synergic Resources Corp., Seattle, WA (USA)). Apr 1987. 257p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920093/JAW.

Report includes 3 diskettes designed to run on IBM PC or compatible equipment.

This report summarizes historical, national, and regional energy consumption patterns compiled from federal and private data sources. These data have been assembled into an integrated database useful to analysts, strategic planners, and decision makers. The database focuses on electricity use, energy supply, and market saturations of end-use devices and provides EPRI and its member utilities with a clearer understanding of how electricity use has evolved over time. The data also describe the use of competing fuels and the composition of energy demand by end-use sector. Opportunities to modify customer usage patterns can also be identified using this database. This volume presents the data in tabular form and also provides the data on IBM PC-compatible diskettes. 35 refs., 54 tabs.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 11156, 11179, 11180, 11204, 11270, 11354, 11605, 11625, 11641, 11671

11656 **(DOE/OR/21389—8) The Northeast Directory of Biomass Facilities.** (Biomass Energy Service Team, Falmouth, ME (USA)). 1987. Contract FG05-83OR21389. 287p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88003554/JAW.

The Northeast Directory of Biomass Facilities is a comprehensive list of industries, businesses, institutions and utility companies located throughout the Northeast that use wood and wood wastes for fuel. Facilities included in the directory were identified through extensive research on wood energy use in the eleven-state region including Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Maryland and Delaware. The Northeast Directory of Biomass Facilities is designed for public and private decisionmakers interested in evaluating the use of woodfuels at their facilities. The directory provides the name, location, contact person, and general information on approximately 400 industries, businesses and utility companies using wood for energy in 1986. In addition, more extensive information is provided on the design, engineering, maintenance and economics of about 200 wood-fired facilities that provided more detailed descriptions of their operations. The major emphasis of the director is wood-fired facilities larger than 3 million BTU's per hour that burn wood and wood wastes in heating systems or power plants that include automatic or semi-automatic woodfuel handling and processing equipment. Selected smaller representative facilities also listed. The director includes some information on hand-fed chunkwood heating systems that are increasingly being used in small businesses, municipal buildings, garages and other facilities. Please note that there are no facilities listed for Delaware and Rhode Island because there were no large facilities in operation at the time of publication.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

11657 **(ANL/MHD—86-1) Analysis of the potential for backwall burnout in MHD radiant boilers.** Berry, G.F.; Wang, C.S.; Choi, U.S. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003265/JAW.

A potential problem with the radiant boiler of MHD power plants is burnout of the backwall by a high-temperature, particle-laden impinging gas jet from the diffuser. This problem has been analyzed both for the Coal Fired Flow Facility (CFFF) at the University of Tennessee Space Institute and for retrofit-sized MHD plants. The analysis indicates that the decay of gas velocity and temperature is negligible as a result of the short distance between the diffuser outlet and the backwall. For the present boiler design of the CFFF and the retrofit, the backwall will be susceptible to burnout because of the high temperature of the gas entering the radiant boiler. This high diffuser-exit gas temperature does not have sufficient distance to cool down before impinging on the backwall. If the particle loading is higher and/or the refractory melting temperature is lower than assumed, the potential burnout problem becomes even more severe. The formation of a slag layer on the refractory surface will mitigate the burnout problem if the slag layer can form in the region of high jet velocity. However, because the slag layer will be molten and, therefore, may be easily blown away, this improvement could be small.

11658 **(DOE/ET/15601—T35) Diagnostic development and support of MHD test facilities: Quarterly technical progress report, October-December 1987.** (Mississippi State Univ., Mississippi State (USA). MHD Energy Center). 1987. Contract AC02-80ET15601. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003817/JAW.

Preparation for the CO_2 CARS concentration measurements began. The dye laser system was modified for the CO_2 CARS measurements. The pump beam optics were realigned so one dye cell could be used as the oscillator and the amplifier of the dye laser. Several CO_2 CARS spectra have been successfully recorded in the CH_4/O_2 flame using this modified dye laser system. A new particle size measurements laboratory was set up on the fourth floor of the CVM complex. Preliminary design work, including both optical and electronic aspects, was begun to improve the instrument for field use. Preliminary results including temperatures and number densities have been obtained from the data taken at the DOE/CFFF LMF4-K test.

11659 **(DOE/ID/01745—T15) [M.H.D. operating contractor]: Quarterly technical progress report, July 1-September 30, 1987.** (MSE, Inc., Butte, MT (USA)). 1987. Contract AC07-78ID01745. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002649/JAW.

This quarterly technical progress report presents the tasks accomplished at the Component Development and Integration Facility during the fourth quarter of FY87. Areas of technical progress this quarter included: coal system development; seed system development; test bay modification; channel power dissipation and distribution system development; service and instrument air upgrade; materials testing; combustion carbon balance and stack gas analysis; coal-fired combustor (CFC) support; 1A channel refurbishment; channel support systems upgrade; arc observation project; test operations and results; data enhancement; data analysis and modeling, and projected activities. 11 figs., 5 tabs.

3003 Thermoelectric Generators

11660 **Progress toward a mercury heat engine - synthesis of a mercury electrolyte.** Hammetter, W.F.; Farrington, G.C.; Hellstrom, E.E. pp 1429-1432 of IECEC '87; Proceedings of the Twenty-second Intersociety Energy Conversion Engineering Conference, Philadelphia, PA, Aug. 10-14, 1987. Volumes 1, 2, 3, & 4. New York, NY; American Institute of Aeronautics and Astronautics (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Successful development of a mercury heat engine requires the development of a suitable Hg electrolyte. This paper describes the necessary properties of such an electrolyte, and efforts to attain it. Ion-exchange experiments on single crystals of Na(I) beta-double-prime/alumina are described, and some important properties on partially exchanged crystals are reported. Electrical properties of the partially exchanged crystals are like those of other divalent beta-double-prime/aluminas, and the crystals are stable to about 600 C. 8 references.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 11589

11661 **(CANMET—86-8E) An electrochemical analysis of solid electrolyte/electrode systems.** Canaday, J.D.; Kurikose, A.K.; Ahmad, A.; Wheat, T.A. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Aug 1986. 39p. (MICROLOG—87-04514). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $3.95 CAN ($4.75 OUTSIDE CANADA); MF $10 CAN.

The three-phase cell consisting of reactant gases, porous electrodes, and a solid electrolyte is described in electrochemical terms. Electrode processes that cause polarization phenomena are discussed. The use of two-probe and three-probe techniques is presented as well as examples of results obtained for a number of systems. 56 refs., 15 figs., 3 tabs.

11662 **(DOE/ET/11304—2383) Development of molten carbonate fuel cell technology: Quarterly technical status report, July-September 1985.** (Energy Research Corp., Danbury, CT (USA)). Sep 1985. Contract AC21-76ET11304. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE87006507/JAW.

This report summarizes the work performed under US Department of Energy Contract No. AC03-76ER11304 during the quarterly reporting period from July 1, 1985 through September 30, 1985. The overall objective of this program is to develop, fabricate and verify the repeating components of an internal reforming molten carbonate fuel cell stack which meets the component functional requirements as specified in the contract Statement of Work. Significant progress has been made during this period in the development of a creep resistant anode, an internal reforming catalyst, NiO cathode endurance, corrosion resistant bipolar plate materials and tape cast matrix fabrication.

11663 **(DOE/ET/11304—2384) Development of molten carbonate fuel cell technology: Quarterly technical status report, October-December 1985.** (Energy Research Corp., Danbury, CT (USA)). Dec 1985. Contract AC21-76ET11304. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE87006508/JAW.

This report describes the three tasks of this program design: Component development, fabrication, and testing; and verification testing. The objective of the design task is to identify a reference application for an internal reforming power plant and develop a power plant conceptual design. A design control document will be developed and maintained and will include the reference application description and power plant requirements of the reference application. The design control document will define and record the specifications, drawings, and conditions of operation for the complete power plant, dc power section, fuel cell stacks and stack components. Cost goals for the plant elements will also be developed under this task and periodically compared with the cost status of plant elements under development. The objectives of the component task are to develop, fabricate and test components to meet the component functional requirements (CFR). These tests will include status tests, accomplishment tests, and cells for independent testing. Verification tests will be conducted in bench-scale single cell hardware.

11664 **(DOE/ET/11304—2388) Reforming stack development: Quarterly technical status report, October-December 1986.** (Energy Research Corp., Danbury, CT (USA)). Dec 1986. Contract AC21-76ET11304. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87006512/JAW.

This report summarizes that work performed on US Department of Energy Contract No. AC21-76ET11304, "Reforming Stack Development," during the quarterly reporting period from October 1, 1986 through December 31, 1986. The program is divided into

three tasks: Design; Component Development; and Verification Tests. The objective of design is to identify a reference application for an internal reforming power plant and to develop a power plant conceptual design and detailed stack design. The objective of componencelopment is to develop, fabricate and test components to meet the Component Functional Requirements (CFRs) defined by design. The objective of verification testing is to determine if the cell components have attained the CFR goals established.

11665 **(DOE/MC/23263—2501) Cathode dissolution: Quarterly report, January-March 1987.** Shores, D.A. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). Jul 1987. Contract AC21-86MC23263. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001010/JAW.

One important mode of degradation of current MCFCs is the dissolution of the NiO cathode into the electrolyte tile and the subsequent precipitation of Ni in the tile. Over time the performance of the cell degrades, and evantually the cell may short out locally via a bridge of Ni particles between the cathode and anode. The purpose of this program is to further the understanding of the processes which cause degradation of the NiO cathode in MCFCs, especially those processes involving dissolution of the cathode and the transport of soluble Ni species in the electrolyte. 6 figs., 3 tabs.

11666 **(MU—86) Characteristics of solid electrolytes. Final report.** Nicholson, P.S. (McMaster Univ., Hamilton, Ontario (Canada)). 1986. 14p. (MICROLOG—86-01167). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Samples of polycrystalline NYS and NGS were very sensitive to electron beam damage. Preliminary investigations showed the presence of dispersed particles of a glassy-type phase. The Edax analysis shows this glassy phase has a markedly higher concentration of Si compared to the matrix in both NYS and NGS. 9 figs.

11667 (NEDOJ—501, pp 832-840) **Development of phosphoric acid fuel cell power generation system. Dispersed generation low temperature and (low pressure type).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objectives of the project are to study and develop elemental technology for low temperature and low pressure type fuel cell power generation system which aims for the development of distributed fuel cell generating systems, and to design the details and construct a part of a 1,000 KW class power generation plant. To achieve the objectives, study and development were made for the following subjects: (1) Research and development of technology concerning cells: To clarify causes for the deterioration of properties of cells, changes in the platinum distribution in electrodes and matrices were measured, and the movement of platinum was observed. (2) Research and development of lamination technology: The partial model of laminated cells trially constructed in 1983 was operated, and optimum operational conditions were established. (3) Research on elements for the device to improve fuel quality: Behaviors of the improvement device and the response properties of the fuel cell to pressure difference between fuel and air at sudden load changes were studied and demonstrated. (4) Reserach on trial construction and operation of generating plant: Low temperature and low pressure type 1,000 KW class generating plant was designed in detail, and partially constructed. (6 figs)

11668 (NEDOJ—501, pp 841-849) **Development of phosphoric acid fuel cell power generation system. Substitute thermal power plant (high temperature and high pressure type).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objectives of the project are to study and develop elemental technology for high temperature and high pressure type fuel cell power generation system which aims at the development of fuel cell generating systems to substitute for thermal power plants, and to design the details and construct a part of a 1,000 KW class power plant. To acieve the objectives, study and development were made for the following items: 1) Research and development of technology concerning cells: To obtain stable properties of catalysts under conditions of high temperature and high pressure, properties of catalysts were evaluated under simulated operation conditions of the cell, and states of catalyst particles before and after the cell operation under high temperature and high pressure were observed and evaluated. 2) Research and development of lamination technology: Characteristics and practicability of the cell stack of 100 KW scale were studied using the evaluation test equipment. 3) Research for trial construction and operation of a power plant: A high temperature and high pressure type 1,000 KW class power plant was designed in detail, and the fuel cell, quality improvement device, control system, and balance of plant were designed and partially constructed. (4 figs, 2 tabs)

11669 (NEDOJ—501, pp 851-857) **Development of power generation system with molten carbonate fuel cell. Trial production of power plant (matrix type electrolyte).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

The objectives of this project are the development of elemental technologies such as material selection, methods of formation and production, lamination as well as the development of a 10 KW class cell to pave the way for future development of practical large scale laminated cells. To achieve the objectives, the following research and development were carried out: 1) Research for trial production and performance evaluation of the unit cell: As regards the research for material selection and methods of formation for electrodes, stability of electrode materials over a long period of time and production methods of electrode including optimization of its structure were studied. In the trial production and performance tests of the small size unit cell, performance of the unit cell of maximum 900 cm^2 was improved. 2) Development of lamination technology for the cell: Structures of separators having good gas dispersion property were studied. In addition, for trial production and evaluation of KW class laminated cells, components for the 900 cm^2 cell were made on a trial basis, and the properties of the cell were evaluated. (8 figs)

11670 (NEDOJ—501, pp 601) **Development of power generation system with molten carbonate fuel cell. Trial production of power plant (paste type electrolyte).** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on the R/D project on a fuel cell power generation system. (1) Trial making and testing of a single cell; A method to form an electrolyte layer by blending alumina fibers and an organic binder, etc. with a powder mixture of lithium aluminate and carbonate. Its heat-resistant cycle property was improved by blending ceramic fibers. In order to prevent a cross-over phenomenon, forming conditions of an perforated and sintered electrode with a double hole structure were established. Basic specification of the internally modified catalyst was clarified. A trially-made 30 cm square single cell showed a stable characteristics in 900-hour continuous test. (2) Development of lamination technology; Structure of a cell for equalizing a gas flow was investigated. A compact layer-built cell (5 - 20 cells) was trially made as well as a 1 KW layer-built cell with 20 single cells of 30 cm square which generated the power of 1.25 KW. (3 figs)

11671 **(PB—88-112800/XAB) 40-kW fuel-cell field-test summary: utilities activities report. Final report, June 1981-June 1987.** Racine, W.C.; Londos, T.C. (Science Applications International Corp., San Diego, CA (USA)). Jul 1987. 85p. (SAIC—87/1730). NTIS, PC A05/MF A01.

Forty-six 40-kW fuel-cell power plants were field tested by 37 host participants at 42 sites in a variety of commercial, light industrial, and multi-family residential applications. The participants obtained over 300,000 hours of operating experience with the power plants covering a diverse range of applications for power plant electricity and heat utilization in both single and multiple-unit installations.

11672 (PB—88-132733/XAB) Competitive analysis of advanced fuel cells: economic analysis and market projection methodology. Topical report, May 1983. Preble, B.S.; Hirshberg, A.S. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). May 1983. 100p. NTIS, PC A05/MF A01.

This study aims to examine the market potential of advanced fuel-cell concepts versus alternative conventional technologies (diesel generators with heat-recovery systems, natural gas-fueled gas turbines with heat-recovery steam generators, and pulverized-coal boilers with steam turbines) and advanced technologies (advanced diesel engines with heat-recovery systems, natural gas-fueled gas-regenerative turbines with heat recovery steam generators, and atmospheric fluidized-bed boilers with steam turbines). The economic analysis considers the equivalent life-cycle cost of energy supplied to 39 specific processes representing nine basic industries (primary metals, chemicals, lumber and wood products, food and kindred products, petroleum refining, textiles, papers, rubber products, and transportation equipment). The study also estimates the allowable fuel-cell cost for a variety of industrial cogenerative and competitive technology applications and the sensitivity of allowable fuel-cell cost to fuel price variations, process/application parameters, and economic factors. Results indicate that advanced fuel cells may be economically competitive in the industrial cogeneration markets in the 1990s.

11673 (PB—88-133491/XAB) Solid-oxide fuel-cell technology development. Annual report, May 1, 1986-April 30, 1987. Jones, A.R. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). Jul 1987. 65p. (REPT—1273-5). NTIS, PC A04/MF A01.

This GRI project builds on the extensive Westinghouse background in the technology of the tubular solid-oxide fuel cell that has been supported in part by the U.S. Department of Energy and its predecessor agencies. The effort is focused on successful application of pipeline natural gas without the need for external reformation of the fuel. The project is divided into 5 technical tasks: Anode Development, Generator Design and Testing, Production of Cells, Cell Life Testing and Model Development. Variables being investigated include: fuel, temperature, steam-to-carbon ratio and fuel fractional utilization.

11674 (PB—88-853551/XAB) Fuel-cell electrodes, January 1970-November 1987 (citations from the US Patent data base). Report for January 1970-November 1987. (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 86p. NTISPC N01/MF N01.

Supersedes PB—86-852456.

This bibliography contains citations of selected patents concerning electrodes of fuel cells used in industrial and medical applications. Methods of manufacturing metal, polymer, gas, and fluid electrodes, and their evaluation with respect to chemical stability, electrical conductivity, and reactant control are described. Reactant-produced waste heat and gas removal and utilization are discussed. (This updated bibliography contains 196 citations, 29 of which are new entries to the previous edition.)

11675 (QU/P—8112) Specification of equipment and methodology for the automated conductivity testing of ceramics. Bell, M.F. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics). Dec 1981. 16p. (MICROLOG—84-0186). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The understanding of the electrical properties of solids and solid-liquid interfaces is of fundamental importance in the design of energy storage devices such as solar cells and fuel cells. A method for the measurement of these properties is known as the a.c. impedance technique which involves the perturbation of the system by a small amplitude, a.c. voltage. Although this technique has been used widely to measure the properties of electrode interfaces, it has recently become popular for the measurement of the ionic conductivity of solids. This report describes the essential requirements of an automated system as required for the measurement of the ionic conductivity of solids. Both the computing facilities and the measurement instruments are discussed in detail. 2 figs., 4 tabs.

11676 (QU/P—8409) The development of electrodes for solid electrolytes. Final report. Phase 1. Sayer, M.; Nicholson, P.S. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics). Sep 1984. 35p. (MICROLOG—85-5965). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The electrochemical aspects of fuel cell technology were reviewed to establish the criteria for the selection of suitable electrode materials. Based on these criteria, six materials were chosen for further study. For the hydrogen electrode, porous films of molybdenum were prepared by plasma-spraying. In contrast, for the oxygen electrode, electrodes of NiCo/sub 2/O/sub 4/ were prepared by chemical decomposition of the nitrates. Finally, thin films of La/sub 2/NiO/sub 4/ were deposited on a number of substrates.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 11295

11677 (ECRC/M—2183) Radiant heating with quartz linear lamps; calculation methods. McIntyre, D.A. (Electricity Council Research Centre, Capenhurst (UK)). Jul 1987. 32p. Electricity Council Research Centre, Capenhurst, Chester CH1 6ES, UK.

The introduction of radiant heaters fitted with Quartz linear lamps is opening up new possibilities for radiant heating, allowing accurately designed distribution of heat over the working area. This memorandum presents the basic information and calculation techniques which are required for radiant heater design, including the following topics: 1) Standard definitions and nomenclature, 2) Angular co-ordinate systems, 3) Geometrical calculation formulae, 4) Physical data on clothing, skin absorption, 5) Data on atmospheric transmission, 6) Effects on comfort, 7) Eye safety.

3201 Buildings

REFER ALSO TO CITATION(S) 10826, 10880, 10884, 11587, 11599, 11671, 11713, 12424, 12433, 12446, 12456, 12464, 12481

11678 (AE/SESRD—1/166) Some methods of insulating basements, walls and windows. (Alberta Energy and Natural Resources, Edmonton (Canada). Scientific and Engineering Services and Research Div.). 1987. vp. (MICROLOG—87-05000). Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, Alta., Canada T5K 2M4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The amount of heat lost from residential buildings by conduction through walls, doors and windows can be reduced by adding insulating materials to the walls and by choosing types of windows and doors that conduct very little heat. While substantial research effort has been directed at development of insulating techniques and materials suitable for new homes, owners of existing homes are not being provided with all the advice they need to make informed choices about energy-conserving options. To help provide some of this needed guidance, three projects were initiated which deal with practical comparisons of various types of exterior basement insulation, an evaluation of optional systems that might be used to upgrade the insulating characteristics of existing walls, and development of an insulating curtain for windows.

11679 (BMFT-FB-T—86-188) Ventilation in buildings, the Berlin demonstration multi-family dwelling. Final report. Rouvel, L.; Nikolic, V. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Forschungsstelle fuer Energiewirtschaft, Muenchen (Germany, F.R.)). Dec 1986. 268p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88750980/JAW.

The aim of this research project was to carry out measurements concerning the usage of heating and air ventilation in several

flats. The resulting data were to find out the connection between habits of airing and use of heating temperature. The objects of the measurements were 9 flats in a building with 6 floors in Berlin, in which different variations of ventilation were realized. Two of the flats were additionally provided with an electrically heated air-construction. Two flats remained uninhabited to serve as comparison. The duration of the opening of windows of the individual rooms lasted in the average up to 15 hours per day during the whole heating period. The tenants own evaluation of the duration of airing differed immensely from this result. The specific use of heating temperature in kWh/m/sup 2/ dwelling space was naturally lowest in the unhabited flats. The highest result was about 200% above the measurements of these flats, in which - at a medium room temperature of 22.8degC - the temperature was kept at the same level by opening the windows while the radiators were in full action due to highest setting of the thermostat valves. With 37 tabs., 115 figs.

11680 **(BMFT-FB-T—86-189-Pt.1) ERIK - energy saving in the hospital. Pt. 1. Final report.** Nikolic, V.; Niche, W.; Canzler, B.; Apel, H.; Schaefer, H.; Rouvel, L.; Blank, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Forschungsstelle fuer Energiewirtschaft, Muenchen (Germany, F.R.)). Dec 1986. 306p. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88750981/JAW.

In the field of hospital-research the ERIK-study stands for a first effort to qualify the streams of energy in a hospital's significant parts and thus to make perceptible the presuppositions for efficient use of energy in operation. Aim of the research was to analyse the important positions of consumption by extensive measurements and, using the gained facts, to work out dispositions for the reorganisation of energy-use in hospitals. In the occasion has been distinguished between short- and medium-term measures. Following exact measurements at isolated positions of the plant, statistic inquiries of consumed quantities of energy, observation of the actual running, recommendations were acquired by means of the gained information concerning the different measures of sanitation. The result is a voluminous documentation of found out data concerning the architectural state, organisation pattern, ways of management, technical plants and the order in time of particular streams of energy. In the recommendation is acquired the efficient proceeding in analysing a hospital which is to sanitate. To the use of a hospital's projectors and operators, important connections are stated, which determine the consumption of energy in mutual dependence to factors of influence. In a second phase the gained results should be applied to a concrete case of sanitation. Based on this study a handbook to projectors and operators will be published within the scope of an IEA-Project with the conclusions of experiences from other countries. With 13 refs., 105 tabs., 208 figs.

11681 **(BMFT-FB-T—86-189-Pt.2) ERIK - energy saving in the hospital. Pt. 2. Final report.** Nikolic, V.; Niche, W.; Canzler, B.; Apel, H.; Schaefer, H.; Rouvel, L.; Blank, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Forschungsstelle fuer Energiewirtschaft, Muenchen (Germany, F.R.)). Dec 1986. 239p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88770025/JAW.

This document presents a study of the streams of energy in a hospital's significant parts and thus to make presuppositions for efficient use of energy in operation.

11682 **(BMFT-FB-T—86-230) Inventory of the design of ventilation systems in residential buildings. Final report.** Haberda, F.; Meyringer, V.; Trepte, L. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 202p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751227/JAW.

Objective of the inventory was to list and to describe ventilation systems which are on the market, to show their possible limited use in practice, to summarize the experience in the operation of the systems and an economical and energetic assessment. In addition tendencies and developments have been described. With 19 refs., 17 tabs., 68 figs..

11683 **(DOE/CE/63508—T3) The Energy General Store, sunscreen production and sales: A business plan for Tucson Urban League.** Clarke, R.; Goldberg, A.; Johnson, C.; Robinson, M. (Arizona State Government, Phoenix (USA)). Jun 1987. Contract FG01-86CE63508. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003302/JAW.

The Tucson Urban League, in an effort to reduce its dependence on federal grants for the operation of community programs, proposes to establish a profit-making component of the agency which has been named Park Avenue Enterprises. Initially, Park Avenue Enterprises will consist of three divisions: Wood Unlimited, Weatherization-Home Repair, and The Energy General Store. Wood Unlimited will market, fabricate, and install wood products including cabinets, pallets, crates, and other custom items. The Weatherization-Home Repair division of PAE will be labor intensive and designed to provide unique energy-saving services. Finally, The Energy General Store division of PAE will provide goods and services conducive to principles of energy conservation: sunscreens, low-flow showerheads, energy-efficient light bulbs, toilet tank insert, and other conservation items. The Energy General Store is also planned to be a resource for information and ideas in energy and water conservation. This plan will use sunscreen production and marketing as its focus.

11684 (JSES—602, pp 93-96) **Experimental study of various air type radiation cooling devices (Part 2). Rock bed cold storage/discharge characteristics.** Kuroki, Megumu; Tanaka, Toshimutsu. (Tokai Univ., Kanagawa, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

The rock bed, a storage of cold media generated by an air type radiation cooling device, is theoretically analyzed for the effects of air flow direction, air flowrate, inlet air temperature and absolute humidity of air at inlet which are influential to its cold storing/discharging properties. A theoretical equation is derived from coble temperature in a certain section from the inlet, temperature of heat media air, absolute humidity of saturated air and the absolute humidity of heat media air. In the summer of 1982, atmospheric air cooled by the cooling device is cold stored in the rock bed while discharging the cold by flowing room air onto the rock bed during daytime. Experimental and calculated values agree considerably. For designing this system, various factors must be judged comprehensively including the temperature/humidity conditions in the air conditioning room and the combination of rock bed and the air type radiation cooling device.(10 refs, 6 figs, 1 tab)

11685 (JSES—602, pp 97-100) **Study on various chemical heat pump reaction systems using liquid ammoniate in low temperature side.** Miura, Toshinobu; Saito, Hiroyuki; Ito, Shigeru; Yoneda, Noboru. (Science Univ. of Tokyo, Faculty of Science and Tech., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

Relationship between operating conditions and heat value, for a large $NiCl_2$-NH_3-NH_4NO_3 base heat storage system of a theoretical heat storage of about 120 kcal, is studied while also examining a new heat storage system applicable to a temperature range of 80-150°C. Reaction heat is measured with the $NiCl_2$-NH_3-NH_4NO_3 system, from temperaturize of water for analyzing relationships between oil temperature, NH_3 flowrate system pressure, temperature and heat storing time in the low temperature side. It is proved that physical heat can be taken out because of favorable moving speed of NH_3 and reaction speed during heat discharge. In addition, a small model proved that a combination $MgCl_2$, $NiSO_4$, $CuCl_2$ ($6NH_3$) in the high temperature side and $NH_4NO_3.nNH_3$ in the low temperature side is hopeful to store heat in a range of 80-150°C. (3 refs, 8 figs, 1 tab)

11686 (JSES—602, pp 101-104) **Study on air conditioning by directly circulating heat storing underground water.** Umemiya, Hiromichi; Kobayashi, Hirokazu; Ikeda, Tadashi. (Yamagata Univ., Faculty of Engineering, Yamagata, Japan; Toshiba Engineering and Construction Co., Ltd., Tokyo, Japan). Dec 1986. (In Japanese). NTIS (US Sales Only), PC A09. Order Number DE88770029/JAW.

In Proceedings of the 12th Symposium of Japan Solar Energy Society.

A floor temperature conditioning system is trially manufactured using low-cost PVC hose, particularly effective for using the water of moderate temperature. Cooling and heating experiment and theoretical analysis are performed for continued application of water. Underground water is pumped up and moderately cooled to 14°C by a heat exhanger and fed to the test building as cooling media, confirming satisfactory cooling effect. In addition, the warm temperature of 25°C is pumped to a machinery works as heating medium, thus confirming the maintenance of a room temperature of 7°C and a floor temperature of 13°C by passing the water at 1.6 l/ min even at an atmospheric temperature of -8°C. A theoretical analysis is performed by substituting the concrete surface with a circular tube having a heat transmission surface equal to the concrete surface per heat conducting tube. The surface temperature can now be calculated for each inlet water temperature and room temperature, effectively preventing due condensation. The same equation can be used for cooling and heating to calculate room temperature for each water temperature. (12 figs)

11687 (LB—1/87-2Ed.) **Air curtains.** (Building Services Research and Information Association, Bracknell (UK)). May 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751259/JAW.

Higher levels of energy efficiency in new and upgraded buildings mean that open doorways are often the area where most energy is lost. An air curtain prevents the penetration of outside air through an opening by forcing a layer of air of predetermined thickness and velocity over the entire entrance opening. A bibliography lists references to literature on the design and applications of air curtains. 63 refs.

11688 (ORF—ES/ESC/83/30) **Thermal performance characteristics of commercial pre-fabricated metal chimneys for use with oil, wood and gas furnaces. Final report.** Butters, B. (Ontario Research Foundation, Sheridan Park (Canada)). 17 Oct 1983. 50p. (MICROLOG—84-0767). CANMET/ TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report summarizes the work carried out by the Ontario Research Foundation for thermal performance evaluation of prefabricated metal chimneys for use with oil, gas, and wood fired heating systems. A total of nineteen chimneys was tested. Thermal conductivity temperature profiles and thermal gradients at thermal bridge locations were determined for each chimney tested. Tests were also undertaken to establish if condensation of the flue gas occurred during the performance tests. The information presented will aid in the understanding of corrosion corrosion mechanisms which can occur in this type of heating system. 4 figs., 1 tab.

11689 (ORNL/CON—236) **An analysis of the impact of residential retrofits on indoor temperature choice.** Dinan, T.M. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003729/JAW.

The objective of this study is to determine whether or not households choose higher winter indoor temperature levels after their houses have been made more energy efficient. A theoretical model for explaining household temperature choice is developed using a household production function approach. A means model, fixed effects model, and random effects model are used to sort out the observed variation in the pooled cross-section/time-series data set of monitored indoor temperature levels. This analysis reveals that the HRCP residential retrofits resulted in a statistically significant increase in indoor temperature levels. Assuming the average level of increase in efficiency among the sample homes, these results imply a .6°F average increase among the sample homes. The average level of takeback among low income households is .9°F, as opposed to the .6°F increase observed in the sample as a whole. Homes that used electricity as their sole heating fuel had significantly lower levels of takeback, averaging .3°F.

11690 (ORNL/Sub—86-56525/1) **Assessment of foam-in-place urethane foam insulations used in buildings.** Tye, R.P. (Dynatech Scientific, Inc., Cambridge, MA (USA)). Oct 1987. Contract AC05-84OR21400. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003692/JAW.

Objective of this assessment was to obtain information on the parameters involved in the production and performance of foam-in-place urethane thermal insulation materials and systems. The adequacy of current information on the relevant physical, mechanical, and thermal properties was addressed related to new applications and climatic areas. Information was obtained from an extensive literature review and discussions with over fifty noted people involved in this field. The principal conclusions are as follows: foam-in-place materials are used extensively in all areas of the USA. The current major use is for new and retrofit spray application on roofs; the materials have significant future potential use for the building envelope and especially for new or modified designs of structure; some problem areas have been identified, in flat roofs and particularly relating to environmental parameters and misapplication; initial cost is a deterrent to use, but true cost effectiveness has not been evaluated; and significant research efforts are on-going or planned but more work is required to develop more appropriate test methods to obtain relevant properties needed to model and validate long term performance. 20 refs., 16 figs., 5 tabs.

11691 (PB—88-109020/XAB) **Radiant heating with quartz linear lamps: calculation methods. Research memo.** McIntyre, D.A. (Electricity Council Research Centre, Capenhurst (UK)). Jul 1987. 38p. (ECRC/M—2183). NTIS, PC E05/MF E05.

The introduction of radiant heaters fitted with Quartz linear Lamps (QLL) is opening up new possibilities for radiant heating, allowing accurately designed distribution of heat over the working area. This memorandum presents the basic information and calculation techniques required for radiant-heater design, and includes the following topics: Standard definitions and nomenclature; Angular co-ordinate systems; Geometrical calculation formulae; Physical data on clothing and skin absorption; Data on atmospheric transmission; Effects on comfort; and Eye safety.

11692 (PB—88-110010/XAB) **Source book for energy auditors. Volume 1.** Lyberg, M.D. (SEE CODE- 5964200 Swedish Council for Building Research, Stockholm). Apr 1987. 353p. NTIS, PC E13/MF A01.

See also Volume 2, PB—88-110028; Report on Energy Conservation in Buildings and Community Systems Programme, Annex XI: Energy Auditing.

The aim of the Source Book for Energy Auditors is to provide practitioners in the field of energy auditing with a structured collection of material that will assist in improving the auditing process, based on the accumulated knowledge and experience of experts from a number of countries. The material consists of a systematic approach to auditing, supported by a detailed collection of technical material ranging from auditing procedures to techniques for analysis and measurement. Formulae and instruments cannot be a substitute for experience and knowledge in solving the problem, but the effectiveness of energy auditing can be improved if it is undertaken systematically and if experience and knowledge is documented in an organized and structured manner. It will also be more effective if the building owner has a clear idea of what should be achieved. This is the aim of the Source Book. The knowledge was compiled by experts from all participating countries, and evaluated and modified sometimes with assistance from other experts in their countries.

11693 **(PB—88-112818/XAB) Integrated natural-gas-engine cooling-jacket vapor-compressor program. Annual progress report (Phase 1B) January-December 1986.** DiBella, F.A.; Becker, F.; Balsavich, J. (TECOGEN, Inc., Waltham, MA (USA)). Jan 1987. 123p. (TE—4369-1-87). NTIS, PC A06/MF A01.

See also PB—86-215662.

A unique, alternative cogeneration system was designed that will provide an industrial or commercial energy user with high-pressure steam and electricity directly from a packaged cogeneration system. The Integrated Gas Engine Vapor Compression System concept includes an engine-generator set and a steam screw compressor mechanically integrated with the engine. The gas-fueled engine is ebulliently cooled, thus allowing its water jacket heat to be recovered in the form of low-pressure steam. The steam is then compressed by the steam compressor to a higher pressure, and when combined with the high-pressure steam generated in the engine's exhaust gas boiler it provides the end user with a more-usable thermal-energy source.

11694 **(PB—88-113238/XAB) Understanding air-conditioning systems for better energy efficiency: operations and maintenance procedures for utility cost control.** Graves, P.; Burger, C.; Tuma, S.L. (Natkin Service Co., Peoria, IL (USA)). Aug 1987. 71p. NTIS, PC A04/MF A01.

This manual provides both systems and equipment operation explanations and guidelines for no and low cost strategies to encourage energy-cost control in new and existing Illinois state building A/C systems. Such guidance should provide a better understanding of simple operations and maintenance changes that can result in significant savings of energy use and cost in Illinois state buildings.

11695 **(PB—88-113568/XAB) Damaging freezing processes at heat output with earth heat pump systems).** Freden, S. (Statens Vaeg- och Trafikinstitut, Linkoeping (Sweden)). 1987. 24p. (In Swedish). (VTI—320). NTIS, PC E03/MF A01.

The aim of the project was to study the problems of frost heave due to freezing around earth heat pipes and especially the risk of these pipes wandering upwards. Calculations and tests show that the type of accumulated heave may occur and that it is possible to estimate the risk from the properties of the ground and the pipe temperature.

11696 **(PB—88-116199/XAB) Living in highly insulated buildings. Research memo.** Brundrett, G.W. (Electricity Council Research Centre, Capenhurst (UK)). Mar 1987. 22p. (ECRC/M—2121). NTIS, PC E04/MF E04.

Low-energy houses may now incorporate controlled ventilation with heat recovery to complement high levels of thermal insulation. Four families who purchased such houses have been studied. Much of the savings available from reduced energy losses was used to operate the house at higher temperatures. The mechanical ventilation system was successful not only in removing smells but, by bringing moisture under control, it provided many unexpected benefits. Thus windows remained clear throughout the year, the towels dried quickly, and the salt and sugar flowed freely and open food packs such as breakfast cereals stayed crisp.

11697 **(PB—88-116207/XAB) Consumption profiles for gas- and oil-heated hot water in houses and a comparison of usage patterns with electrically heated water. Research memo.** Stephen, F.R.; Mason, C. (Electricity Council Research Centre, Capenhurst (UK)). Jun 1987. 64p. (ECRC/M—2154). NTIS, PC E06/MF E06.

A survey of the consumption of electrically heated hot water was undertaken by the Electricity Council Research Center, and consumption profiles derived from the data collected. The survey was extended to include a small number of houses with gas and oil systems heating the domestic hot water, thus enabling consumption profiles to be obtained and compared with electrically-heated systems. The results show that gas- and oil-heated systems exhibited hot-water consumption profiles with three major demand periods a day similar to those determined for electrically-heated systems. For all three types of water-heating systems, the day of maximum demand was found to be Sunday. Electrically-heated systems consumed the largest average volumes of hot water, gas the smallest.

11698 **(PB—88-119128/XAB) Reducing energy costs in multifamily housing: guidelines for using energy-management companies.** Shafer, P. (Synectics Group, Inc., Washington, DC (USA)). Mar 1986. 100p. NTIS, PC A05/MF A01.

This publication is designed to provide guidelines to help sponsors of multi-family projects assisted or insured by the U.S. Department of Housing and Urban Development (HUD), as well as other building owners, utilize performance agreements as a way to make energy-efficiency improvements. These guidelines are based on experience gained in a demonstration project initiated by HUD to test the feasibility of using Energy Management Companies (EMCs) to make energy improvements in assisted housing for the elderly or handicapped.

11699 **(PB—88-129986/XAB) Research, development, and demonstration of a high-efficiency gas-fired central forced-air residential furnace. Final report, July 1979-July 1980.** Huang, V.; Cole, J.T.; Elkins, R.H.; Macriss, R.A. (Institute of Gas Technology, Chicago, IL (USA)). May 1981. 72p. (IGT—30527). NTIS, PC A04/MF A01.

Utilization of fluidized-bed heat transfer in the design, fabrication, and operation of a high-efficiency, condensing-flue, gas-fired, forced-air, central residential furnace was demonstrated. A breadboard unit 4.5 feet tall, 2 feet (front-to-back) long, and 10 inches wide was designed, fabricated, and tested in the laboratory. The gas-input rate to this breadboard was varied between 25,000 and 40,000 Btu per hour. The unit was operated repeatedly and long enough and demonstrated: A condensing-flue, steady-state furnace efficiency of 92%; Reasonable levels of power consumption for fluidization; and An overall heat-transfer coefficient for the fluidized-bed heat exchanger (flueside to airside heat transfer) of 44 Btu/hr-sq ft-deg F.

11700 **(PNL-SA—14229) Commercial building energy use monitoring for utility load research.** Mazzucchi, R.P. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1987. Contract AC06-76RL01830. 25p. (CONF-870101—15). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002084/JAW.

From American Society of Heating, Refrigerating, and Air-Conditioning Engineers meeting; New York, NY, USA (18 Jan 1987).

This paper describes a method to acquire empirical data regarding commercial building energy performance for utility load research. The method was devised and implemented for a large scale monitoring program being conducted for a federal electricity marketing and transmission agency in the Pacific Northwest states. An important feature of this method is its hierarchical approach, wherein building types, end-use loads, and key building characteristics are classified to accommodate analysis at many levels. Through this common taxonomy and measurement protocol, energy-use metering projects of varying detail and comprehensiveness can be coordinated. The procedures devised for this project have been implemented for approximately 150 buildings to date by specially trained contractors. Hence, this paper provides real-world insights of the complexity and power of end use measurements from commercial buildings to address utility load research topics. 6 refs.

11701 **Lightwell to atrium conversions.** Erwine, B.; Hancock, C.; Littler, J. (Lawrence Berkeley Lab., CA, USA; Polytechnic of Central London, UK). *Energy and Buildings;* 24, 26, 28-29, 35(Sep 1987). (CONF-8709207—).

From Atria conference; London, UK (10 Sep 1987).

Lightwells have been a popular architectural response to the desire for natural ventilation and light to the interior of deep plan buildings. Recent concerns over energy efficiency and reduction of building operating costs have brought into question the inherently high exposed surface to building volume ratio of the lightwell. Many building owners are now considering conversion of existing lightwells into atria. An evaluation of the overall effectiveness of

these conversions requires a thorough understanding of the potential benefits and liabilities.

11702 **Innovative Stirling engine driven heat pump concepts.** Ross, B.A.; Fisher, G.A. pp 1880-1884 of IECEC '87; Proceedings of the Twenty-second Intersociety Energy Conversion Engineering Conference, Philadelphia, PA, Aug. 10-14, 1987. Volumes 1, 2, 3, & 4. New York, NY; American Institute of Aeronautics and Astronautics (1987). (CONF-870804—).

From 22. intersociety energy conversion engineering conference; Philadelphia, PA, USA (10 Aug 1987).

Stirling engine driven heat pumps (SEDHP) are potentialy efficient systems that can use a wide variety of fuels. Unlike the waste heat sent to the cooling tower in a large power plant, the heat rejected from the cooler of the Stirling engine can be added to the heat provided by the heat pump. Recent advances with high-efficiency electric motors, alternators and magnetic couplings, using permanent magnets made of neodymium iron, allow SEDHP to be designed in a wide variety of configurations using both kinematic and free-piston engines. These innovative concepts may help solve control problems and the problem of coupling the Stirling engine with the system compressor. 7 references.

11703 **Coming in from the cold: Energy-wise housing in Sweden.** Schipper, L.; Meyers, S.; Kelly, H. Washington, DC; American Council for an Energy Efficient Economy (1985). 104p. American Council for an Energy Efficient Economy, 1001 Connecticut Ave. NW, Suite 535, Washington, DC 20036.

Swedish homes use less energy for heating than those in any other country. They maintain the highest standards of indoor comfort, even at the higher temperatures Swedes prefer. In this book, three U.S. scientists look closely at the building practices and technologies along with the interaction between consumer demand and government incentives that have made Swedish homes a model of high quality and low fuel consumption. In the course of the two-year study, the authors interviewed leaders in every sector of the Swedish housing industry.

3202 Transportation

REFER ALSO TO CITATION(S) 10793, 11581, 11764, 12431

11704 **(NP—8751245) Final development of the duo-bus system. Technical final report.** Niemann, K. (Daimler-Benz A.G., Berlin (Germany, F.R.). Forschungsgruppe Berlin; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1986. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751245/JAW.

The Diesel engines and electric motors fitted in the newly developed duo-buses drive the rear vehicle axis alternately (rear wheel drive). A generously illustrated detailed survey with tables and diagrams gives information on structural, functional and test characteristics. Starting from considerations of economy, the vehicle design is shown and design details of the vehicle are described (construction of vehicle, wheels and axles, arrangement of axles, braking system, wheels, tyres, springs, steering) and the electrical components (driving motor, DC controller, ventilation/cooling, braking resistance, current pantograph, accessories). Experience is given on its use, testing and operation. The relatively high manufacturing and running costs of the duo-bus are regarded as a disadvantage. However, the advantages consist of the lack of waste gases (in electrical operation at site), the better use of energy with regenerative braking feedback to the mains supply and the greater independence from petroleum, as well as the only partial electrification of the line network, which is necessary. (HWJ).

11705 **(PB—88-112354/XAB) Financial analysis of integrating small buses to a conventional bus fleet. Final report.** Monroe, M.J.; Barker, W.G. (De Shazo, Starek and Tang, Inc., Dallas, TX (USA)). Aug 1984. 13p. NTIS, PC A03/MF A01.

This analysis presents issues that face a system contemplating a change from standard buses to small buses. A detailed analysis of the feasibility of using smaller buses is shown using the example of a study undertaken for CITRAN, the City Transit Service of Fort Worth, Texas. Benefits ascribed to smaller buses include better economy on a vehicle-mile basis, a lower initial purchase price, and a better public image of cost efficiency for the property. Detriments include costs associated with training of drivers and mechanics, increased complexity of operations, increased space for parts, and maintenance of dual inventories of other items. When costs are compared, it is economical to switch to smaller buses only for a large property's low-demand routes.

11706 **(PB—88-113444/XAB) State rural public-transportation coordination: a review. Final report.** Greene, M.J. (Council of State Governments, Lexington, KY (USA)). Oct 1986. 121p. NTIS, PC A06/MF A01.

During the summer of 1986, the Council of State Governments Center for Agriculture and Rural Development conducted a 50-state survey of state programs to coordinate the rural public and specialized transportation programs funded by the Urban Mass Transportation Administration. Some 41 states now have some kind of coordination mechanism in place to improve the level and availability of public transportation in rural areas. Though they all share the objectives of reducing or eliminating duplicative and uncoordinated transit services, they vary considerably in scope and power. The survey also examined the contracting process as applied to rural and specialized systems, the sources and amounts of operational funding for 16(b)(2) operators, and the extent and coverage of Section 18 rural service. Specific barriers to coordination included conflicting Federal regulations regarding clientele, lack of uniform accounting and billing procedures, lack of state coordination enforcement authority at the state level, and lack of local funds for start-up or operations of coordinated systems.

11707 **(PB—88-115506/XAB) Traffic forecasting for pavement design. Final report, July 1985-December 1986.** Desai, H.R.; Reel, R.; Deen, R.C.; Southgate, H.F.; Noble, R. (Florida Dept. of Transportation, Tallahassee (USA)). Dec 1986. 166p. NTIS, PC A08/MF A01.

Improved estimates of current traffic loadings would allow development of procedures for making improved estimates of historical traffic loadings and better forecasts of traffic loadings during a design period. The emergence of automatic vehicle-classification equipment, permanent and portable weigh-in-motion (WIM) systems, and the application of microprocessors and microcomputers to these data-acquisition functions now offer tools that may be used effectively in meeting these needs. Representatives from four States (Florida, Kentucky, Oregon, and Washington) met on several occasions to discuss the subject of traffic forecasting for pavement design. Information was compiled on all aspects of the traffic-forecasting process, options were presented for each step of the process, and recommendations were developed to assist highway agencies in improving current practices and procedures.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 10738, 10739, 10740, 10741, 10742, 10749, 10750, 10787, 10856, 10886, 11596, 11636, 11870, 12065, 12444, 12564

11708 **(BA—831120) Methodology for measurement of heat of hydration of non-ferrous slag binders. Final report.** Berry, E.E. (Berry (E.E.) and Associates, Ottawa, Ontario (Canada)). 20 Nov 1983. 13p. (MICROLOG—84-1286). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Sources of non-ferrous slags in Canada that are produced in significant quantities are the copper, nickel and lead producing industries. Quenched slags from these industries have been examined as low-grade supplementary cementing materials for such applications as mine backfill and waste stabilization. To determine the manner in which such slags contribute to the cementitious activity of hydraulic systems, the course of their hydration should be examined. One tool for such investigation is the conduction calorimeter. Its use is becoming increasingly common in the study of the mechanism and kinetics of cementing processes. This report is concerned

with the practical application of conduction calorimetry to the determination of heats of hydration of blended cements and supplementary cementing materials based on non-ferrous slags. In addition some consideration is given to the research applications of conduction calorimetry in as much as they are extensions of the methodology employed to determine simple heats of hydration. 5 figs.

11709 **(BFH/S—30901/7000) Enersolve Demonstration Projects. Nestle Ltd., Chesterville, Ontario.** Gauthier, A.T. (BFH/Shawinigan, Ottawa, Ontario (Canada)). 4 Apr 1983. 48p. (MICROLOG—84-1283). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The Enersolve program is concerned with increasing efficiency of utilization of oil, gas and waste fuels in industrial processes. This stage of the program is intended to support a limited number of site-specific retrofit projects as a means of documenting the economics of such projects to older equipment. A stationary converted waste fuel boiler was identified and tested at the Nestle Food Processing Plant in Chesterville, Ontario. A modified Input-Output method was completed to obtain satisfactory evaluation results for potential savings. It was estimated that some $225,000 worth of control retrofit and recommended boiler modifications could result in efficiency improvements and reduce fuel requirements valued at $210,000 based on continuous operation of the boiler. The plans and specifications could be done within three months, expenditures within twelve months, followed by a monitoring period of nine to twelve months.

11710 **(BISI—24490) Ways of reducing energy consumption in welding.** Salagean, Tr. (Institute of Metals, London (UK)). Feb 1986. 18p. British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks .

Transl. of Metalurgia (Bucharest), 1984, No. 11, p. 589-593. Price $22.

A detailed analysis of welding processes and their respective energy consumptions is given and ways of saving energy and suggested.

11711 **(BM—8412) Electricity utilization. Trends in underground mining.** White, P. (Brampton Mining Co. Ltd., Ontario (Canada)). Dec 1984. 100p. (MICROLOG—86-01219). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The Canada Centre for Mineral and Energy Technology (CANMET) is actively involved in encouraging the development of mining technology for the Canadian hard rock mining industry. This document is one of a series prepared to analyze specific potential equipment applications in hard rock mines. The contents of this report have been based on visits to selected mines, and discussions with equipment manufacturers and mine inspectorates from across Canada. It presents the results of the investigations regarding the increased underground application of electrically powered equipment. A synopsis of current energy utilization practices in underground mines is included, with detailed reference to the various uses of electricity. Equipment and operations that use or have potential for using electricity are discussed. The possibility of increased electrification is examined from the perspectives of safety, technical feasibility, and economy.

11712 **(BMFT-FB-T—86-200) Saving of electrical energy by the use of vertical roller mills for cement grinding. Final report.** Kaemmerer, E.A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88750983/JAW.

As the grinding of cement in ball mills is not energy efficient, a procedure was tried by grinding in a bed of material for greater efficiency. This is the report of the initial tests, the optimising for various sorts of cements and the following three years of operation. The influence of the operating parameters during grinding on the quality of the cement is pointed out. The effect of the abrasive and jet wear on the grinding elements, the inner walls of the mill housing and other internals are described and the measures taken to reduce wear. The connection between energy saving and wear are discussed. Results demonstrate, that the energy efficiency is greater than by grinding in ball mills. The finer the cement, the greater energy savings. The vertical roller mill will be an energy saving and economical cement mill, if the experiences made are considered. With 5 refs., 2 tabs., 5 figs.

11713 **(CG—8609) Prototyping and testing the retrofit of residential gas fired furnaces with induced draft fans and intermittent spark ignition. Final report.** (Conserver Group, Inc., Winnipeg, Manitoba (Canada)). Sep 1986. 63p. (MICROLOG—87-02205). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The primary purpose was to establish the technical feasibility of retrofitting conventional gas fired furnaces with intermittent spark ignition and induced draft fans in the field. The secondary purpose was to determine the effect of the retrofit on the steady state and seasonal efficiencies of the furnaces, and to perform a cost/benefit analysis. Two used gas furnaces and one used gas conversion oil furnace were tested in a laboratory as conventional units, retrofitted and then retested in the laboratory to determine the effects of the changes. The tests performed in both cases included temperature measurements, pressure (draft) measurements, and flue gas analyses. In addition, the effectiveness and/or requirement for furnace safety controls was tested. Steady state efficiency improvements of 2.2%, 14.6% and 9.9% were obtained for the three furnaces tested. In addition, seasonal efficiency improvements of 18.2%, 30.6% and 25.6% were estimated. It is technically feasible, as well as cost effective, to retrofit a conventional gas fired furnace with an intermittent spark ignition and an induced draft fan in the field. 7 figs., 3 tabs.

11714 **(CU—84) Development of high strength concrete using less energy intensive materials.** Johnston, C.D. (Calgary Univ., Alberta (Canada)). 1984. 24p. (MICROLOG—84-5064). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The terms semi-lightweight or sand-lightweight are commonly employed to describe concretes made with natural sand and structural lightweight aggregate. Semi-lightweight concrete, like other forms of concrete, depends for its strength on a low water/cement ratio. In this investigation, a superplasticizing admixture is used to achieve relatively low water/cement ratios at a relatively high level of workability, thus increasing the strength potential of the matrix without loss of workability. The effect of varying the composition of the cementitious matrix in terms of proportions of cement and fly ash is also examined. Since fly ash is a by-product of the firing of electric power generating plants with powdered coal, its cost is not energy-related, in contrast to cement where almost half the cost derives from the energy consumed in firing the kiln. Not only are fly ashes cheaper and less energy-intensive materials than cement, but they also have excellent cementitious properties. This allows fly ashes to substitute for a significant proportion of the cement normally required without loss of concrete strength and with some saving in direct costs. 15 tabs.

11715 **(DOE/ID/12440—3) Mathematical modeling of two-state classification technology transfer summary and user's guide.** Baltich, L.K. (AMAX Extractive Research and Development Center, Golden, CO (USA)). Aug 1987. Contract FC07-83ID12440. 118p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003849/JAW.

CIRCUIT is a computer program developed for use in designing optimum two-stage classification configurations and operating conditions for energy conservation. It was developed in a cooperative effort between AMAX Research & Development Center and the US Department of Energy, Conservation Technologies Division. This document contains the final summary report for the technology phase of the project and the User's Guide for CIRCUIT. CIRCUIT is now available for use with IBM compatible personal computers.

11716 **(DPC—830831) Energy conservation in investment casting using Candian industrial minerals. Final report.** Breckenridge, B.; Twiss, D. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics). 31 Aug 1983. 85p. (MICROLOG—84-1276). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report describes the work perfomed by Designed Precision Casting Inc. The technical portion of the program was carried out mainly at Ontario Research Foundation. A laboratory process for the manufacture of ceramic shell molds at low firing temperature (600/sup 0/C) has been developed. This comprises the development of four promising slurry compostions to produce ceramic shell molds with substantial increase in strength. The fired strength of these ceramic mold materials fired at 600/sup 0/C is about 1300 psi as compared to about 800 psi of the standard industial shell molds normally fired at 1000/sup 0/C. The key to the development lies in the successful identification, development and use of phosphate binders. 8 figs., 13 tabs.

11717 **(FE—42723) Enersolve Demonstration Project. Pre-engineering assessment.** (Fenco Engineers, Inc., Toronto, Ontario (Canada). Minerals and Metals Div.). Oct 1985. 46p. (MICROLOG—86-01221). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Fenco Engineers Inc. investigated the combustion efficiencies of steel heat treatment furnaces at Algoma Steel's Superior Limited Partnership as part of an energy conservation study in the Enersolve Demonstration Project program. It was found that about 35 percent of the gross heat input was transferred as sensible heat to the steel. The following methods to improve the efficiency were evaluated: furnace sealings and draft control, recycling flue gas between furnaces operating in tandem, and a computerized supervisory control system. Paybacks ranged from about two to more than four years.

11718 **(FERIC—TN/100) An overview of air conditioning in Canadian forest equipment.** Courteau, J. (Forest Engineering Research Inst. of Canada, Pointe Claire, Quebec). Apr 1987. 8p. Forest Engineering Research Institute of Canada, 143 Place Frontenac, Pointe Claire, P.Q., Canada H9R 4Z7; $5.00 CAN.

Increasing awareness of ergonomics have contributed to the demand for climatic control in logging machines. Heat stress studies indicate a loss in motivation, productivity and visual acuity with exposure to uncomfortably warm environments. Many air conditioning systems cannot withstand a logging environment. Options were to use thermoelectric devices, discontinue use of air conditioners and replace with fans or pressurizers, or improve existing air conditioners. This report reviews a current system of cooling and assists present and future users in preventative maintenance and choice of optional systems. 7 figs.

11719 **(FERIC—TN/102) Insulation: one way to optimize the viscosity of gear oils and energy consumption in trucks.** Ljubic, D.A.; Chinnn, G.P. (Forest Engineering Research Inst. of Canada, Pointe Claire, Quebec). Aug 1987. 4p. Forest Engineering Research Institute of Canada, 143 Place Frontenac, Pointe Claire, P.Q., Canada H9R 4Z7; $5.00 CAN.

Users of machinery outdoors in cool and cold weather conditions usually experience operating and maintenance cost penalties particularly during very cold weather. Research projects have been set up for a better understanding of the effects of cold ambient temperature on machine operating conditions. Methods of insulating logging truck axles are discussed. Should insultation be used, it is mandatory that precautionary measures be taken to prevent overheating of gear oils.

11720 **(HA—90361) Pre-engineering assessment of Enersolve project at the Stanton Pipes Foundry.** (Hatch Associates Ltd., Toronto, Ontario (Canada)). 30 Apr 1985. 261p. (MICROLOG—85-5964). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Hatch Associates were retained to provide a pre-evaluation of the potential for increasing the efficiency of oil and gas utilization in foundries. The plant chosen produces ductile cast iron pressure pipes for water distribution systems. Approximately 62% of losses are through the flue gases. A central recuperator to pre-heat combustion air and improve controls would have a total installed cost of $276,100 and annual operating savings of $132,900 with a resultant payback of 2.1 years. Improvements to the combustion control, and an exhaust gas system for regulating furnace pressure would cost about $210,00 with a payback of 2.0 years. This option is an alternative to the recuperator option. Another alternative is a regenerative burner system which would have a total cost of $461,300 and a payback of 3.0 years. A brief survey was conducted of the potential for application of these energy conservation measures to other Canadian foundries. A demonstration project to illustrate the benefits of waste heat recovery will be vital in encouraging other foundries to use waste heat recovery in reducing energy costs.

11721 **(IE—821231) Pre-engineering assessment of Enersolve Demonstration Project at L.E. Shaw Limited, Lantz - Nova Scotia. Final report.** (Interprovincial Engineering Ltd. (Canada)). 31 Dec 1982. 43p. (MICROLOG—84-1706). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The primary objective was to determine the feasibility of applying state of the art control and monitoring system technology to increasing fuel efficiency and decreasing unit costs in the tunnel kiln at L.E. Shaw's brick plant in Lantz, Nova Scotia. Optimization is dependent upon achieving the most efficient rate of heat transfer into the ware in the pre-heating and firing zones and out of the ware in the annealling and cooling zones of the kiln. Redesigning the unit at L.E. Shaw to incorporate advances in control and combustion technology should reduce the fuel bill for the kiln by approximately 48%. Calculating the payback period in the most expensive scenario suggests the system will pay for itself in approximately 1.32 years.

11722 **(KE—8301) Pre-engineering assessments of Enersolve Demonstration Projects. Final report.** (Kent Engineering Ltd., Vancouver, British Columbia (Canada)). Jan 1983. 108p. (MICROLOG—84-1280). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The Department of Energy, Mines and Resources ENERSOLVE program is concerned with increasing the efficiency of utilization of oil and gas in industrial boilers, kilns, furnaces etc. Such process heating equipment, particularly if 10 or more years old, may not be operating or operable at maximum attainable efficiency of fuel use, and some scope may exist to technically upgrade the installation to achieve greater fuel economy. The manner of obtaining more efficient fuel use may vary from better temperature control instrumentation to microprocessor control of fuel/air ratios and flow rates to follow process load. The cost of equipment retrofit should be recoverable through fuel savings over a period of time acceptable to the equipment owner. 3 figs., 4 tabs.

11723 **(KEC/R—7135/01) Pre-engineering assessment of an Enersolve demonstration project at IPSCO Inc. Regina, Saskatchewan.** (Keen Engineering Co. Ltd., Regina, Saskatchewan (Canada)). Apr 1985. 100p. (MICROLOG—85-5937). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The energy utilized in reheating ingots in soaking pits prior to hot rolling into slabs or coiled sheet is significantly influenced by

pit design and external factors. Of the external factors, the time between pouring the ingot and placing it in the soaking pit is the most significant. Delays in delivery of the ingots result in a cooling of the steel and hence additional energy is required to reheat the material to working temperature. Among the pit design features, recuperation and combustion control offer substantial potential for conserving energy. Examination of the recuperator performance at the IPSCO Inc. plant in Regina indicates that operating savings of 12% are readily available through the installation of recuperators. The energy saving techniques discussed in this report are widely applicable to other steel plants and process industries. A brief survey of the use of recuperators in the Canadian steel industry indicates that there exists possible savings of more than $2 million per year through the use of recuperators. Combustion control improvements could contribute another $1 million. 8 figs., 16 tabs.

11724 (KS—830503) A study of the optimum control and conservation of energy in the crystallization, drying and cooling of potash. Final report. (Kilborn (Saskatchewan) Ltd., Saskatoon (Canada)). 3 May 1983. 139p. (MICROLOG—84-1284). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Crystallization and product drying are the most energy intensive processes in the beneficiation of potash ores. Crystallizers are cyclical in nature and the major unit operations that form this circuit have long retention times. These circuits operate with variable feed rate and throughout there are variables that are not directly measurable. Crystallization circuits are complex but have great potential for productivity improvement. Crystallization is becoming increasingly important in the refining of industrial minerals and chemicals. This report deals with a methodology for the analysis of the KCl-NaCl-H/sub 2/O system in the presence of minor amounts of other soluble and insoluble materials. The methodology is illustrated through dissolving/recrystallization for the production of white muriate of potash which is nearly pure crystalline KCl. The example consists of crystallizer units which operate by the natural nucleation and growth of KCl crystals in a supersaturated crystal suspension. This circuit at Central Canada Potash was sampled through in order to provide a data base for the development and refinement of a control methodology. 6 figs.

11725 (NP—8751239) Costs of cleaning and separating gas from refuse tips. Results of an economy study. Ludwig, H.; Linder, K.J. (Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)). 1987. 23p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751239/JAW.

The following treatment processes are considered in an economy study for the preparation of gas from the decomposition of refuse to natural gas quality H: Washing with pressurized water, chemical washing process, variable preasure adsorption, diaphragm separation process. So that the prepared gas from a refuse tip can be fed into the natural gas H network as a replacement gas, the treatment must be such that the gas characteristics of the final gas, which describe the combustion and physical properties and determine the combustion behaviour, are identical with those of the basic gas.

11726 (NP—8770026) Adaptive control algorithms for greenhouse air conditioning. Parlitz, M. (Hannover Univ. (Germany, F.R.). Inst. fuer Technik in Gartenbau und Landwirtschaft). 1986. 253p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88770026/JAW.

The optimized application of microcomputers in air conditioning systems is illustrated by the example of a greenhouse air conditioning system. An outline of the heating and cooling requirements of greenhouses is followed by a systematic review of the available methods of control system optimisation (meshing, prediction, adaptation, coordination). In the main section, a novel control algorithm is established, and its practical results are used for a comparative analysis of control algorithms (set-point algorithms, signal algorithms, control algorithms). A simulation model makes the fast conditions repeatable. (HWJ).

11727 (OH—046268-1/87-2M) Preventive maintenance and testing of electrical equipment in health care facilities. (Ontario Ministry of Health, Toronto (Canada)). 1987. 77p. (MICROLOG—87-04681). Capital Planning Branch, Ontario Ministry of Health, 15 Overlea Blvd., 7th. Floor, Toronto, Ont., Canada M4H 1A9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Health care facilities depend on the continuous supply of electricity and the functioning of electrical equipment and systems. To increase the reliability of the electrical equipment and systems in health care facilities, proper maintenance and periodic testing must be conducted. Preventive maintenance and testing will reduce the danger of sudden failure of equipment, reduce the possibility of shock, and extend the life of the equipment. In health care facilities, unscheduled shut-downs due to equipment breakage are costly and involve undue hazards. Periodic maintenance and testing will allow for repair and replacement of equipment at convenient times.

11728 (ORNL/TM—10415) Efficient alternatives for electric drives. Comnes, G.A.; Barnes, R.W. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 71p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE88003733/JAW.

This analysis of industrial electric motors describes the current motor stock, its energy use and operating characteristics, and innovations that could change current use patterns. It provides calculations characterizing the economic attractiveness of several existing and potential options. One attractive option given particular attention is the adjustable-speed drive which can replace throttles or valves for many pumping operations. A major conclusion is that, throughout industry, options that are both energy-saving and economically attractive appear to penetrate markets more slowly than would be socially optimal. The final section examines characteristics of industry that may contribute to slow market penetration. 29 refs., 14 figs., 14 tabs.

11729 (PB—88-106364/XAB) New approaches to the decontamination of hazardous wastes. Klee, A.J. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Sep 1987. 13p. (EPA—600/D-87/299). NTIS, PC A03/MF A01.

The Hazardous Waste Engineering Research Laboratory is currently supporting a number of research projects to develop innovative chemical and biological systems capable of detoxifying hazardous wastes. Recent emphasis has been on the destruction of chlorinated dioxins, chlorinated dibenzofurans, polychlorinated biphenyls, and related organic compounds in waste liquids and in polluted soils. Using a chemical reagent based upon the reaction of an alkaline metal hydroxide and a polyethylene glycol, over 17,000 gallons of industrial wastes, containing chlorinated dioxins and dibenzofurans at concentrations varying from 400 to 84,000 ppm, were decontaminated to below detection levels (1 ppb in the case of the tetra-dioxins). Bioassay tests have shown that the byproducts produced from the reaction do not bioaccumulate or bioconcentrate, they do not cause mutagenicity, nor are they toxic to aquatic organisms or mammals. The equipment used for these tests is now being modified for use on contaminated soils.

11730 (PB—88-106885/XAB) Energy in agriculture: an overview. Hendtlass, C.A. (Centre for Resource Management, Canterbury (New Zealand)). Jan 1987. 48p. NTIS, PC E03/MF A01.

An awareness of agriculture's dependence on nonrenewable resources led the Joint Center for Environmental Sciences (now the Center for Resource Management) in 1974 to investigate and characterize the energy costs of agriculture in New Zealand, and to evaluate the feasibility of strategies for maintaining production in the face of energy shortages. The project was supported by a contract from the New Zealand Energy Research and Development Committee. The report is an overview of research carried out during the contract period. It describes the nature of the research as a whole, the objectives and methodologies, and the trends in, and importance of, the research. There are obvious difficulties associated with compiling such a summary. The material is both meth-

odologically and temporally diverse. It ranges from the macro- to the micro-level, and from long-term national policy implications to specific assessments of on-farm energy use practices.

11731 (PB—88-107180/XAB) **Waste-minimization audit report: case studies of corrosive and heavy-metal waste minimization at a specialty steel-manufacturing complex.** (Versar, Inc., Springfield, VA (USA)). Aug 1987. 90p. NTIS, PC A05/MF A01.

The U.S. Environmental Protection Agency (EPA) is expanding its efforts to promote waste-minimization activity in the private sector by providing technical assistance to generators of hazardous waste. As part of the effort, the EPA Office of Research and Development/Hazardous Waste Engineering Research Laboratory (ORD/HWERL), Cincinnati, Ohio, is promoting the development of a generalized or model waste-minimization audit (WMA) procedure and testing this procedure in actual production facilities agreeing to cooperate with the audit teams selected for this task. In the report, results are presented of WMAs conducted at generators of corrosive heavy metals wastes. A specialty steel manufacturing complex employing electric arc furnaces (EAFs) for the manufacture of stainless and electrical steels, hot and cold rolling facilities for fabrication of the various steel grades into strip, and annealing and pickling facilities for finishing the strip, agreed to provide host facilities for the WMA effort reported herein.

11732 (PB—88-107636/XAB) **Energy conservation in a small-scale-production engineering facility.** White, M.R. (A and T Burt Mechanical Ltd., Christchurch (New Zealand)). Jun 1987. 88p. NTIS, PC E04/MF A01.

The development, implementation, and results of an energy-conservation program in a small low-energy-consuming industry is reported. The components of the program are described, as well as the actions taken, and savings achieved over a 3-year period. The program achieved significant energy savings and identified the importance of energy management and maintenance procedures in achieving improved energy efficiencies.

11733 (PB—88-107941/XAB) **Oil conservation in food factories. Final report.** Huse, P.; Stockwell, D. (Massey Univ., Palmerston North (New Zealand). Food Technology Research Centre). Feb 1987. 40p. NTIS, PC E03/MF A01.

This report details the work carried out in Phase 1 of the New Zealand Energy Research and Development Committee's sponsored project Oil Conservation in Food Factories. The primary aim of the project is to reduce fuel oil usage in food factories, by the demonstration of more energy-efficient fuel-usage methods and by encouraging the conversion of factories from the use of imported fuel oils to alternative fuels indigenous to New Zealand.

11734 (PB—88-111869/XAB) **Utilization of a saltwater-marsh ecosystem for the management of seafood-processing wastewater.** (Environmental Protection Agency, Atlanta, GA (USA). Region IV). Oct 1986. 198p. (EPA—904/9-86/142). NTIS, PC A09/MF A01.

The report presents the results of a cooperative study that examined the potential for using a saltwater wetland to manage seafood-processing wastewater. An irregularly flooded black needlerush (Juncus roemerianus) marsh located at Point aux Pins in coastal Alabama was selected for the study. The study determined that the application of seafood-processing wastewater to the marsh affected a number of the marsh's water-quality characteristics in direct relation to the wastewater loading rate. However, monitoring of the marsh flora and fauna showed virtually no impact at any of the experimental loading rates. As a result of the study a number of design and loading criteria are suggested for any future projects involving wastewater discharges to saltwater wetlands.

11735 (PB—88-112321/XAB) **Destruction and removal of POHCs (principal organic hazardous constituents) in iron-making blast furnaces.** Adams, R.C. (Radian Corp., Research Triangle Park, NC (USA)). Oct 1987. 94p. NTIS, PC A05/MF A01.

At least one steel company utilizes organic-waste liquids as a heat and carbon content source to partially replace the coke used to charge the blast furnaces. The waste liquids fed to the blast furnace are likely to contain hazardous constituents. Temperature and residence time in the blast furnace favor total destruction of the principal organic hazardous constituents (POHCs) of the waste fuel but verification of destruction efficiencies has not been attempted up to now. Also, reduction reactions that occur in a blast furnace may promote the formation of products of incomplete combustion (PICs). Tests were conducted while feeding waste fuel to a blast furnace located at a major steel mill. The primary objective of the test program was to determine the fate of the POHCs of the waste fuel and to look for formation of PICs, notably dioxins and dibenzofurans.

11736 (PB—88-117866/XAB) **Survey of new industrial boiler projects - 1981-1984. Final report.** White, D.M. (Radian Corp., Research Triangle Park, NC (USA)). Apr 1987. 51p. NTIS, PC A04/MF A01.

The report presents an analysis of new industrial boilers sold between 1981 and 1984. The analysis focuses on 151 new coal-, oil-, natural gas-, and wood-fired boilers larger than 100 million Btu/hour and 291 existing boilers. Specific issues examined in the report include the reasons for purchasing new industrial boilers, the percentage of new boilers used for new applications versus replacement of existing boilers, and the impact of new boiler purchases on sulfur dioxide emissions.

11737 (PB—88-123542/XAB) **Advanced burner and combustion controls for industrial heat-recovery systems. Final report, January 1984-March 1987.** Ferri, J.L. (GTE Products Corp., Towanda, PA (USA). Chemical and Metallurgical Div.). Mar 1987. 203p. NTIS, PC A10/MF A01.

This report details the design and performance of the GTE ceramic burner and temperature compensator. The GTE ceramic burner design requires no cooling air and has no metallic internals. This maximizes efficiency since the preheated air is not diluted with cooling air, and minimizes design constraints because the ceramic construction allows higher turndown. The temperature compensator is an inexpensive device which results in performance similar to expensive ratio-control systems while still using standard pressure-balancing regulators.

11738 (PB—88-130018/XAB) **Development of a gas-engine-driven chiller. Annual report, May 1985-September 1986.** Panora, R.; Koplow, M.; Gehret, J. (TECOGEN, Inc., Waltham, MA (USA)). Jun 1987. 181p. (TE—4373-21-87). NTIS, PC A09/MF A01.

See also report for Jan-Dec 1986, PB—87-216008.

This report covers the first 17 months of activity in a program to develop a natural gas engine-driven chiller with a nominal capacity of 130 tons and an optional waste heat recovery of approximately 6 therms per hour from the engine jacket and exhaust. The system is based on an oil-flooded screw compressor driven by a 454 cubic-inch-displacement automotive engine converted to operate on natural gas. During the period covered by the report, two prototype chillers were fabricated and tested. In the laboratory and in the field, the waste heat was used to power absorption chillers producing at full load about 30 tons of additional cooling, increasing the system COP to 1.65 at full load.

11739 (PB—88-131271/XAB) **Technical resource document: treatment technologies for halogenated-organic-containing wastes. Volume 1.** Surprenant, N.; Nunno, T.; Kravett, M.M.; Breton, M. (Alliance Technologies Corp., Bedford, MA (USA)). Dec 1987. 424p. NTIS, PC A18/MF A01.

See also Volume 2, PB—88-131289.

The halogenated organics technical resource document (TRD) is one of a series of five TRDs that are being prepared by the Hazardous Waste Engineering Research Laboratory. It provides information that can be used by environmental regulatory agencies and others as a source of technical information describing alternatives to the land disposal of nonsolvent halogenated wastes. These alternatives include waste minimization/recovery, treatment, and disposal of waste streams. Although emphasis is placed on the presentation of performance data for proven technologies, information dealing with the applicability of other emerging technologies is presented as well. The treatment technologies discussed in the

TRD include biological treatment as well as the following physical, chemical, and thermal treatment technologies: Physical treatment: (Distillation, Evaporation, Steam-stripping, Solvent extraction, Carbon adsorption); Chemical treatment: (Wet air oxidation, Supercritical water, UV/ozone oxidation, Chemical dechlorination, In situ vitrification); Thermal treatment: (Incineration, Molten glass, Molten salt, Pyrolysis).

11740 (PB—88-853502/XAB) Energy conservation: industry. February 1983-November 1987 (citations from the NTIS data base). Report for February 1983-November 1987. (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 86p. NTISPC N01/MF N01.

Supersedes PB—86-851896.

This bibliography contains citations concerning techniques and equipment and program overviews regarding industrial energy-conservation measures. Topics include case histories and energy audits in a variety of industries, financial and investment aspects, and descriptions of specific energy-conservation projects undertaken in the United States and abroad. The food, metals, pulp and paper, wood, and textile industries are among the industries discussed. (This updated bibliography contains 173 citations, 39 of which are new entries to the previous edition.)

11741 (SCC—C1820) Pre-engineering assessment of an Enersolve Demonstration Project at Rio Algom's Panel Mine. Final report. (Simon-Carves of Canada Ltd., Willowdale, Ontario). 22 Dec 1982. 46p. (MICROLOG—84-1705). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A conversion program was undertaken to modify three boiler units from coal to oil. Programs have recently been initiated to assess the efficiency of the boiler. Steam and heat conservation schemes have been completed and are developing for other aspects of the operation. Based on the operating data obtained and the thermal balance subsequently constructed, a boiler efficiency of 82% was estimated. A number of energy use efficiency improvements were considered based on the boiler operating parameters documented. The Panel Mine projected operating life has been estimated to be in the range of eight to ten years; economic analyses supporting the proposed improvements were considered attractive if payback periods were four years or fewer. All benefit/cost ratios were calculated for four years of operation. The eight efficiency improvement possibilities are summarized.

11742 (SNC—6711) Pre-engineering assessments of Enersolve Demonstration Projects. Final report. Siddiqi, Z.A.; Thomas, A.; Fallecker, A.; Mourad, A.; Khandhadia, P. (SNC Group, Montreal, Quebec (Canada)). 1 Feb 1983. 71p. (MICROLOG—84-1282). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The pre-engineering survey is the first phase of a 4 phase Enersolve demonstration programme aimed at demonstrating energy conservation by effecting improvements in the operating efficiency at a specific plant site. The cement industry is known to be one of the most energy intensive offering a high potential for energy conservation. Testing was carried out at this site to establish data on fuel use, combustion and heat efficiencies of the kiln, the sensible heat recovered in the clinker cooler and to prepare heat balance for the kiln. Conceptual equipment upgrading and retrofit procedures to improve the heat efficiency of kiln were prepared. The capital cost for upgrading and retrofitting, and detailed engineering, procurement and installation have been examined. Based on the potential energy savings to be achieved by upgrading and retrofitting the facility, 47% return on investment is anticipated. 2 figs., 2 tabs.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 11181, 11353, 11654, 11739, 12457

11743 (BCH/RCEM—8607) Demand side management. A progress report. (British Columbia Hydro, Vancouver (Canada). Residential and Commercial Energy Management). Mar 1987. 28p. (MICROLOG—87-04806). Residential and Commercial Energy Management, B.C. Hydro, 3 - 1265 Howe Street, Vancouver, B.C., Canada V6Z 2C8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The B.C. Utilities Commission recommended that B.C. Hydro begin its proposed purchased conservation program. This report was prepared in response. Demand side management refers to the broader utility activities designed to influence customer use of energy in a way that will produce desired changes in the utilities load, and encompasses both load building and load reduction. Strategic energy conservaton is intended to reduce utility load. Market penetration estimates for the residential programs are in addition to the level of conservation already included in the load forecast. Pilot projects have been designed to provide early experience with demand site management so that full scale programs are available to achieve the necessary load reduction when required. Projects have been initiated to determine the impact of higher efficiency residential appliances and commercial energy use.

11744 (DOE/CE/26547—T1) Nome waste heat feasibility study: [Final report]. (Polarconsult Alaska, Inc. (USA)). Nov 1987. Contract FG01-86CE26547. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003348/JAW.

A study was performed to determine if a district heating system for Nome is feasible both technically and economically. The study considers energy usage factors, including weather, climatic aspects, historical factors, population, and energy conservation, energy sources, energy costs, and heat usage. Technical aspects of the district heating system are discussed, as well as cost and economic analysis and financing. It is found that the district heating system utilizing waste heat from generators could save the city of Nome the equivalent of 669,000 gallons of oil per year.

11745 (EY—86004) Dynamic analysis of time-of-use rates for electricity: optimal pricing and investment under welfare maximisation. Asano, H.; Kaya, Y. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Aug 1986. 18p. CRIEPI, 1-6-1 Otemachi, Chiyoda-ku, Tokyo 100, Japan.

Time-of-use rates are expected to reduce energy costs and capacity requirements by load levelling. This paper describes: the basic characteristics of welfare-optimal pricing and investment policy, using optimisation theory: the expansion of theoretical analysis of revenue reconciliation; and the implications for pricing and capacity decisions of a diverse technology where more than one type of plant is available to meet demands.

11746 (PB—88-118229/XAB) District heating and cooling. Final report. Designing, developing, and building a financially viable system in Provo, Utah. (Provo Dept. of Energy Services, UT (USA)). 4 Sep 1985. 34p. NTIS, PC A03/MF A01.

See also DE84-010494.

Contents include: project status: construction and system startup; general introduction; district-heating service areas; Phase I - early start/initial district-heating system; district-heating system growth; power-plant addition; district-heating underground piping system; building retrofits; economic analysis; net revenue analysis; total end-user thermal cost.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 10882, 11755, 11759, 11882, 12051, 12051, 12052, 12052, 12053

11747 (NP—8751238) Effect of filtering the oil on the operating behaviour of commerical vehicle Diesel engines (long intervals between oil changes). Krause, H.; Schmitz, M.; Tiede, H. (Technische Hochschule Aachen (Germany, F.R.). Lehr- und Forschungsgebiet Abnutzung der Werkstoffe; Aachener Strassenbahn- und Energieversorgungs-Aktiengesellschaft (Germany, F.R.)). 1985. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751238/JAW.

The purpose of experiments explained in detail was to check the effects of long intervals between oil changes on the operating behaviour of Diesel engines in the conditions of the use of regular buses in local traffic. The long intervals between oil changes were set at 70,000 km and 35,000 km for the experimental vehicles. Data are given on the stresses affecting lubricants in combustion engines (Diesel engines, changes to the oil, lubricant limits, filter systems for engine oil), on the experimental program (type of engines, engine oil, oil filters, oil test process, measuring process for assessing engines and filters) and on the results of the investigation. An effect on important components of ageing of oil by oil filtering was found; slower ageing of oil reduces the formation of sludge in the crankcase; ageing of oil and pollution of the engines determine the intensity of wear of the engine components. Due to very fine filtering of the engine oil, the state of the oil with time may be so favourable affected that the intervals between the oil changes can be increased. (HWJ).

11748 (ORNL/Sub—86-22042/1) Effect of translucence of engineering ceramics on heat transfer in diesel engines: Final report. Wahiduzzaman, S.; Morel, T. (Integral Technologies, Inc., Westmont, IL (USA)). Oct 1987. Contract AC05-84OR21400. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003732/JAW.

This report addresses the question of translucence of ceramics, and investigates how it influences the net heat transfer to the engine structure. A two flux radiation model was developed to describe radiation within the ceramic, and it was checked and validated against accurate literature results. Based on it, a coupled radiation/conduction model of a ceramic was developed, and it was used in conjunction with time-dependent boundary conditions describing gas-phase heat transfer arising in a heavy duty truck engine operating at its rated point. The model was applied to limiting cases of fully opaque and full transparent materials, and also in a parametric study covering a wide range of ceramic radiative properties encompassing the range of such properties considered possible for heat barrier ceramics. The material thickness and conductivity were varied as well. The results showed that translucence can have significant detrimental effects on heat barrier effectiveness under realistic diesel engine conditions. The most important properties are the absorption and scattering coefficients of the ceramics. As these become less opaque, the total heat flux through the ceramic layer increases. For low conductivity ceramics this increase can amount to 50% and more. Significant effects begin to be felt for absorption coefficients smaller than 10,000 m^{-1} and scattering coefficients smaller than 20,000 m^{-1}. An important parameter is also the heat barrier thermal conductance, i.e., the ratio of thermal conductivity to the layer thickness. It is recommended that radiative properties be among the properties that are measured and reported for ceramic materials. If a particular ceramic is found too translucent, some tailoring of its radiative properties, e.g., by additives, should be considered. 20 refs., 37 figs., 3 tabs.

11749 (PB—88-108030/XAB) High-pressure autoignition of natural gas/air mixtures and the problem of engine knock. Topical report. Westbrook, C.K.; Pitz, W.J. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. 42p. NTIS, PC A03/MF A01.

Although increases in compression ratio can improve the efficiency of most internal combustion engines, including those fueled by natural gas, the onset of engine knock provides an upper limit to the compression ratio at which the engine can be operated. The chemical factors involved in autoignition and knock in these engines are reviewed in the report and those operating parameters which have the greatest influence on the knocking tendency are identified and quantified. The fuel composition (the relative proportions of methane, ethane, and higher hydrocarbons) and the gas-mixture temperature are found to be most important in determining the rate of autoignition, while the equivalence ratio, initial pressure, amount of exhaust gas recirculation, and amount of antiknock additive are of somewhat lesser importance.

11750 (PB—88-109806/XAB) Design methods for duct mufflers at high amplitudes. Final report. Cummings, A. (Missouri Univ., Rolla (USA). Dept. of Mechanical and Aerospace Engineering). Jul 1987. 123p. NTIS, PC A06/MF A01.

The object of the work was to develop design methods for flow-duct mufflers containing perforated structures that are valid at high sound pressures. Detailed modeling of the hydrodynamics of single orifices with no flow, throughflow, and grazing flow was carried out both in the frequency domain and in the time domain. Time-domain models were then applied to single resonators and ducts lined with resonators with successful results; a time-dependent finite difference approximation to the governing equations was utilized in this analysis. The scheme was extended to a muffler consisting of an expansion chamber containing a central perforated tube, with excellent results.

11751 (PB—88-853783/XAB) Internal combustion engines: computer applications. January 1970-November 1987 (citations from the Engineering Index data base). Report for January 1970-November 1987. (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 107p. NTISPC N01/MF N01.

Supersedes PB—85-863033.

This bibliography contains citations concerning the application of computers and computerized simulations in the design, analysis, operation, and evaluation of various types of internal combustion engines and associated components and apparatuses. Special attention is given to engine control and performance. (This updated bibliography contains 255 citations, 70 of which are new entries to the previous edition.)

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 11210

11752 (EPRI-EM—5471) Sealed lead-acid electric vehicle battery: Research and development: Final report. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1987. 64p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920082/JAW.

A multi-year cell development effort leading to a sealed lead-acid battery for fleet electric vans has been completed. The cell design features a calcium-tin alloy using thin grids in a deep cycle application. A horizontal element positioning is used in conjunction with positive axial pressure which is applied to the element stack in order to extend cycle life. Cell operation at 45°C provides a means to augment the specific power and specific energy characteristics. Four engineering models, incorporating several design and operational variables, were constructed and tested at JPL. At the time the program was discontinued, 400 cycles had been achieved; this coincided with near-term program objectives. 4 refs., 34 figs., 14 tab.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 11704

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 11704

11753 (DOE/AL/33183—T5) Multidimensional modeling of convective heat transfer with application to IC engines: Technical progress report. Jennings, M.J.; Morel, T. (Integral Technologies, Inc., Westmont, IL (USA)). 11 Dec 1987. Contract AC04-86AL33183. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003398/JAW.

The objective of this project is to develop a more comprehensive understanding of the convective heat transfer process in complex, unsteady turbulent reacting flows, typical of those which occur in internal combustion engines. The specific area of research is the representation of heat transfer in detailed multi-dimensional Navier-Stokes models, and modeling of turbulent transport mechanisms. The detailed tasks include a review of relevant prior work. Based on this review, and original work done under this contract, several modeling approaches are being formulated and will be further studied and tested. The tests will be carried out on flow cases which have relevance to engine flows, and for which reliable experimental data exist. This report discusses the results of current work and describes experiments to be performed.

3307 Emission Control

REFER ALSO TO CITATION(S) 12420, 12463

11754 (MI—85) Diesel/mineral sensor. Final report. (Metrex Instruments Ltd., Brampton, Ontario (Canada)). 1985. 75p. (MICROLOG—85-6072). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Suspended particulate matter in mines originates primarily from breaking of the rock and from the operation of diesel engines and pneumatic equipment. Large particles will sediment out of the air, while the particles of a small size fraction remain suspended and constitute a health hazard. The health hazard curve presented is constructed from the frequency of particles found in the lung tissue of deceased miners by optical microscopy. Diesel exhaust particulates are a relatively recent concern. An important component of the mine atmosphere is the oil mist, dispersed by the moving components of pneumatic machinery. The liquid oil particles are mostly under 1μm in size. The concentration, size distribution and composition of airborne particulates in the mine can be presently established by the technique of filter trapping and subsequent analysis by laboratory methods. The requirements of industrial hygiene wuld be satisfied better by an in-situ type of technique capable of distinguishing between the two major classes of airborne paricles, mineral dust and diesel exhaust. In addition to the light scattering technique of aerosol detection for mineral and diesel components, the ionization technique for the detection of diesel fumes was investigated. Both techniques are detailed. A microprocessor-based technique of signal recording, analysis and logging provides an instant display, an analog output, and a one-week store of data that can be discharged into a printer after each shift or weekly. 9 figs.

11755 (PB—88-100516/XAB) Heavy-duty engine testing report. Correlation testing of Mack EM G-285. Technical report. Baines, T.M. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jan 1987. 40p. (EPA/AA/SDSB—87/2). NTIS, PC A03/MF A01.

This report examines the results of testing the Mack EM G-285 heavy-duty engine at the Environmental Protection Agency Motor Vehicle Emission Laboratory. This heavy-duty engine was tested for the purpose of providing correlation data for the comparison with similar data developed by Mack Laboratory. The engine, fuels, test procedures, and test plans are also discussed in the report.

11756 (PB—88-101068/XAB) Effect of sampling technique on the measurement of gasoline volatility. Technical report. Scarbro, C.A.; White, J.T. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1987. 18p. (EPA/AA/EOD/TPB—87/1). NTIS, PC A03/MF A01.

The U.S. Environmental Protection Agency is proposing the adoption of regulations that would reduce the amount of hydrocarbons released to the atmosphere due to evaporation of gasoline. One regulatory alternative under consideration is to put an upper limit on volatility. Volatility is typically quantified by measurement of Reid vapor pressure. The purpose of the report was to identify and quantify any differences in vapor pressure caused by the technique used to obtain the sample. The objective of the effort is identify and document a fast, inexpensive, and reliable method to obtain enforcement-quality samples at service station-type facilities. The report examines the effect of four sampling techniques and two methods of analysis on three types of fuels.

11757 (PB—88-102926/XAB) Evaluation of several methods to measure volatility of motor fuels. Technical report. Haubenstricker, M.E.; Scarbro, C.A. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1987. 30p. (EPA/AA/EOD/TPB—87/2). NTIS, PC A03/MF A01.

The U.S. Environmental Protection Agency is proposing regulations to reduce the amount of hydrocarbons released to the atmosphere due to the evaporation of automotive fuels. The new regulations may define upper volatility limits for these fuels based on seasonal climatic patterns. Volatility of gasoline fuels is typically quantified by measurement of Reid vapor pressure (RVP). Although an established procedure exists for the assessment of the parameter (ASTM S 323), there is question as to the accuracy of the procedure when evaluating fuels with water-interactive constituents, e.g., alcohols and ethers. ASTM P 176 is a procedure that has been proposed as its replacement. It addresses the problem of water and is known as the dry version of ASTM D 323. The correlation study was designed to evaluate the proposed ASTM P 176 procedure for repeatability and reproducibility. The results of the study will help establish a basis for enforcement tolerance. Also evaluated was the equivalency of results from two commercial instruments versus those obtained by the traditional gauges and bath techniques.

11758 (PB—88-102934/XAB) Draft regulatory impact analysis: proposed refueling emission regulations for gasoline-fueled motor vehicles. Volume 2. Additional analysis of onboard controls. (Environmental Protection Agency, Washington, DC (USA). Office of Air and Radiation). Jul 1987. 49p. (EPA—450/3-87/001B). NTIS, PC A03/MF A01.

See also Volume 1, PB—87-221677.

This report assesses the economic impact of onboard control of refueling emissions in terms of the costs to automobile manufacturers, costs to the consumers, total cost to the nation, and the overall socio-economic impact of the proposed regulations. Air quality benefits of the effect of refueling emissions control on ambient ozone levels is also summarized.

11759 (PB—88-107768/XAB) Chemical methods for the measurement of unregulated diesel emissions - carbonyls/aldehydes, particulate characterization, sulfates and PAH/NO_2PAH. Perez, J.M.; Jass, R.E.; Leddy, D.G. (Coordinating Research Council, Inc., Atlanta, GA (USA)). Aug 1987. 60p. (CRC—551). NTIS, PC A04/MF A01.

The progress report summarizes research conducted on unregulated diesel-emissions methods by the Chemical Characterization Panel of the Coordinating Research Council's Diesel Composition Group over the past three years. Methods are recommended for the measurement of aldehydes/carbonyls, sulfates, particulate characterization, polycyclic aromatic hydrocarbons (PAH), and nitrated PAH (NO_2 PAH). Most of the methods proposed are the result of cooperative testing and are considered to be based on sound engineering practices.

11760 (PB—88-109897/XAB) Vapor generation of fuels. Final report, April-June 1987. Smith, L.R. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1987. 79p. NTIS, PC A05/MF A01.

This report combines the data from two previous work assignments conducted at Southwest Research Institute for the Environmental Protection Agency, and analyzes the resulting data set. When possible, the combined results are generalized in order to draw conclusions. In the first work assignment, vapors from twelve gasolines and gasoline/alcohol blends were analyzed for butanes, total hydrocarbons, methanol, and appropriate cosolvent alcohols. The analyses were conducted in duplicate for each fuel at FTP diurnal SHED temperatures (60-84 F) and at typical hot-soak temperatures (160 + or - 10 F). The fuels were prepared with different levels of aromatic content and Reid Vapor Pressure. The second work assignment study involved generating vapors from seven gasolines and gasoline/alcohol blends during simulated diurnal test conditions (15-40 F, 35-60 F, and 60-84 F). These vapors were analyzed for total hydrocarbons, alcohols, and individual hydrocarbons up to and including C6. The Reid Vapor Pressure of the seven fuels varied from 9.2 to 15.0 psi.

11761 **(PB—88-115001/XAB) Air-toxics emissions from motor vehicles. Technical report.** Carey, P.M. (Environmental Protection Agency, Ann Arbor, MI (USA). Technical Support Staff). Sep 1987. 129p. (EPA/AA/TSS/PA—86/5). NTIS, PC A07/MF A01.

This report is designed to be a compilation of available information on emission levels of potentially carcinogenic substances from motor vehicles. While earlier EPA reports discussed air-toxics emissions in general, their main emphasis was not mobile sources.

11762 **(PB—88-115084/XAB) Motor vehicle tampering survey - 1986. Final report.** Greco, R. (Environmental Protection Agency, Washington, DC (USA). Div. of Field Operations and Support). Sep 1987. 85p. (EPA—460/1-87/001). NTIS, PC A05/MF A01.

See also report for 1985, PB—87-139168.

The Environmental Protection Agency conducted a survey of 7541 light-duty motor vehicles for tampering with emission-control devices. All vehicles inspected were classified into one of four mutually exclusive categories: tampered (at least one control device removed or rendered inoperative), arguably tampered (potential, but not clear-cut tampering), malfunctioning, and okay (all control devices present and apparently operating properly). The results were: tampered-20%, arguably tampered-25%, malfunctioning-1%, and ok 54%.

11763 **(PB—88-116934/XAB) Automotive exhaust emissions at low ambient temperature. Research report.** Laurikko, J.; Nylund, N.O.; Sipilae, K. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1987. 43p. (VTT/RR—496). NTIS, PC E03/MF A01.

Cold ambient conditions have a distinct impact on the total emission of the Finnish car park because climatic conditions in Finland are rather severe regarding the use of automobiles. In the present study, the exhaust emission characteristics of three automotive petrol engines with different fuel-metering systems were evaluated. Experiments were carried out on an engine and exhaust system combination in a cold chamber at a constant ambient temperature ranging from +20C to -30C. Test procedures included either constant or variable load mode during a 30-minute run. The test results show that the use of the enrichment devices necessary during cold-start and warm-up period has a major impact on the total emissions during the test.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 11168, 11175, 11760

11764 **(CONF-8711104—1-Vugraphs) The Department of Energy's Federal Methanol Fleet Project: A progress report.** McGill, R.N. (Oak Ridge National Lab., TN (USA)). 12 Nov 1987. Contract AC05-84OR21400. 25p. (CONF-8711105—1-Vugraphs). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002688/JAW.

From Mid-south section meeting of the Society of Automotive Engineers; Nashville, TN, USA (12 Nov 1987).

DOE's federal methanol fleet demonstration project is introducing methanol-fueled vehicles into government fleet operations with considerable success. The viability of methanol vehicles is being demonstrated, and vehicle technology is almost mature enough for production vehicles. Drivers seem to accept methanol vehicles as perfectly adequate compared to gasoline vehicles. Where the project goes from here with methanol vehicles is a function of need, economics and/or government initiative. These viewgraphs summarize the project results.

11765 **(FERI—TN/101) Propane substitution for logging truck engines.** Clark, M.L. (Forest Engineering Research Inst. of Canada, Pointe Claire, Quebec). Apr 1987. 8p. Forest Engineering Research Institute of Canada, 143 Place Frontenac, Pointe Claire, P.Q., Canada H9R 4Z7; $5.00 CAN.

The objective was to review research done on propane substitution applicability to highway log hauling and evaluate potential for reducing logging-truck operating costs. An economic analysis of the potential fuel cost savings from propane substitution on a logging truck was conducted. Conclusions are that additional laboratory work is required on a propane regulator prior to field testing.

11766 **(NP—8751234) Methanol for transport - an estimate.** Meyer, H. (Daimler-Benz A.G., Berlin (Germany, F.R.). Forschungsgruppe Berlin). Jan 1985. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751234/JAW.

The suitability of methanol as a fuel is well-known; motor designs exist and can be developed ready for mass-production with predictable expense. Against this background, the conditions and connections of the prospects for methanol are critically examined. Data on this concern the importance of methanol (raw material, manufacturing process, properties as fuel), the technical basis of the methanol production process and the cost basis of large scale methanol production (imports, production in Germany, comparison with import price for petrol). The competitive situation of methanol from the consumer's point of view (effect of higher vehicle costs, distribution costs, type of taxation) and the availability (imports, methanol from German brown coal) are also explained. Finally, the uncertainties of development are shown. These are seen in the taxation of fuels and the development of oil prices, for the introduction of methanol fuel, for petrol from methanol instead of methanol and in the raw materials hard coal and natural gas. (HWJ).

11767 **(PB—88-102595/XAB) Vehicle driveability with gasoline/alcohol blends. Technical report.** Adler, J.; Harvey, C.A. (Environmental Protection Agency, Ann Arbor, MI (USA). Technical Support Staff). May 1987. 24p. (EPA/AA/TSS/PA—86/02). NTIS, PC A03/MF A01.

See also DE—86-004278.

This report addresses the issue of vehicle driveability with gasoline/ethanol and gasoline/methanol cosolvent blends. Oxygen content, volatility, heat vaporization, intake system deposits, driveability test programs, and fleet programs are also examined.

11768 **(PB—88-132154/XAB) Environmental benefits of CNG-fueled vehicles. Topical report, November 1986-May 1987.** Hull, R.W. (Southwest Research Inst., San Antonio, TX (USA)). Jun 1987. 64p. NTIS, PC A04/MF A01.

Report on Nox Control Technology Database for Gas-Fueled Prime Movers.

A study was performed to identify significant environmental, safety, and economic benefits associated with CNG-fueled vehicles relative to gasoline-, methanol-, and diesel-fueled vehicles. From an environmental viewpoint, natural gas was shown to be a cleaner fuel than gasoline or diesel, and is considered to be as safe or safer than gasoline. The exhaust emissions from natural gas-fueled engines are typically lower in CO, reactive HC, particulates, metals, and aldehydes than from gasoline or diesel fuel. An opportunity to expand CNG usage into urban bus and truck fleets by replacing diesel fuel was identified.

35 ARMS CONTROL

11769 (AD-A—184910/8/XAB) Soviet military on SDI (Strategic Defense Initiative). Professional paper. Fitzgerald, M.C. (Center for Naval Analyses, Alexandria, VA (USA). Naval Warfare Operations Div.). Aug 1987. 41p. (CNA-PP—461). NTIS, PC A03/MF A01.

Numerous Western analysts have suggested that all American assessments of SDI should proceed not only from a consideration of American intentions, but also from the outlook of Soviet perceptions. Since 23 March 1983, the prevailing tone of Soviet military writings on SDI has been overwhelmingly negative. Myron Hedlin has concluded that this harsh reaction to a U.S. initiative still years from realization suggests both a strong concern about the ultimate impact of these plans on the strategic balance, and a perceived opportunity for scoring propaganda points. Indeed, the present review of Soviet writings since President Reagan's so-called Star Wars speech has yielded both objective Soviet concerns and regressions to psychological warfare. This, in turn, has necessitated a careful effort to separate rhetoric from more official assessments of SDI. While there has long been dispute in the West over the validity of Soviet statements, they have time and again been subsequently confirmed in Soviet hardware, exercises, and operational behavior. Some Western analysts will nonetheless contend that the Soviet statements under examination in this study are merely a commodity for export.

3501 Policy, Negotiations, And Legislation

REFER ALSO TO CITATION(S) 11067, 12399

11770 (AD-A—184841/5/XAB) Soviet perspectives on British security policy: a reader. Final report. Clark, S.L.; Lacy, J.L. (Center for Naval Analyses, Alexandria, VA (USA). Naval Warfare Operations Div.). Oct 1986. 201p. (CRM—86-159). NTIS, PC A10/MF A01.

How the Soviets perceive developments in U.S. security policy is a matter of understandable interest to U.S. security analysts and military planners. Less well known in American security circles, but also a matter of pertinent interest, are Soviet views about the defense policies, postures, and politics of key U.S. allies. This reader, part of a series of CNA reports concerning the western alliance is an initial step toward filling the gap in the case of one such ally: the United Kingdom. A collection of original translations of recent authoritative essays in a Soviet journals and the Soviet press, the reader provides a rich introduction to Soviet perspectives on the multiple dimensions of British security.

3502 Proliferation

11771 (IAEA-INFCIRC—345) Request by the Permanent Mission of Nigeria. Text of a letter to "Die Presse" from the Permanent Mission of Nigeria. (International Atomic Energy Agency, Vienna (Austria)). Aug 1987. 2p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700796/JAW.

3503 Verification

11772 (PB—88-107958/XAB) High-resolution satellite imagery simulation. Ekblad, U. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jul 1987. 36p. (FOA-C—30462-3.3/9.3). NTIS, PC E03/MF A01.

In order to investigate the possibility of using satellites in verifications of military and disarmament treaties, simulations of satellite images are presented. A column of tanks on a road in a terrain model was used as an example of military activities. With the half-width of the PSF (point spread function) as a measure of resolution, the spatial resolution needed for detection was found to be 8 m.

36 MATERIALS

REFER ALSO TO CITATION(S) 11626, 12271

11773 (AD-A—185091/6/XAB) European Science Notes. Volume 41, Number 10. Fox, C.J. (Office of Naval Research (USA). London Branch Office). Oct 1987. 71p. (ESN—41-10). NTIS, PC A04/MF A01.

European Science Notes is a monthly publication with brief articles on recent developments in European scientific research. Partial contents include: Report on the NSIA International Conference on Military Personnel and Training, with Special Emphasis on Computer Adaptive Testing and Training; The 2nd International Symposium on Quantitative Luminescence Spectrometry in Biomedicine; Control Theory at the National Technical Univ. in Greece; Research in Superconductivity at Cambridge Univ, UK; Research on Fuel Cells and MOCVD (Metal Organic Chemical Vapor Deposition) at Imperial College; Composite Materials; Conference in France; Prospectives in Turbulence Studies--An international symposium; Von Karman Institute for Fluid Dynamics; The Marginal Ice Zone Experiment--MIZEX-87; The Oceanography Session of the European Remote Sensing Meeting (May 87); Basic Research in Optoelectronics, Optics, and Laser Science at Berlin; Physics and Microelectronics Research at the Institut Superieur d'Electronique du Nord; The Few-Body Problem--IAU Colloquium, No. 96, Turku, Finland.

11774 (AD-A—185242/5/XAB) ONR (Office of Naval Research) Far East Scientific Bulletin. Volume 12, Number 2, April-June 1987. Wright, G.B.; Kawano, S. (Office of Naval Research Liaison Office, Far East, APO San Francisco 96503). Jun 1987. 162p. NTISMF A01.

See also Volume 12, Number 1, AD-A182 404; Availability: Superintendent of Documents, GPO, Washington, DC 20402 PC $4.50 Microfiche furnished to DTIC and NTIS users.

Partial contents include: High-Temperature Oxide Superconductors in Japan; The Indian Department of Ocean Development; International Conference on Semiconductor and Integrated-Circuit Technology, Beijing, China; Propeller-Hull Interaction Research in Japan; Third U.S.-Japan Seminar on Dielectric and Piezoelectric Ceramics; Visits to Some Heat Transfer Research Groups in Japan; Chinese Institute of Electronics 1986 International Conference on Radar; Three Out-of-the-Ordinary Hydrodynamics Research Investigations Underway in Japan; Research Activities of Kajima Corp. including some technical details of carbon-fiber-reinforced cement; International Conference on Laser Advanced Materials Processing; Optoelectrics Joint Research Laboratory--A review of accomplishments; International Meetings in the Far East, 1987-1994.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 10667, 10692, 10693, 10694, 10712, 10717, 10768, 10914, 10934, 10937, 11038, 11393, 11395, 11408, 11409, 11411, 11411, 11418, 11442, 11443, 11444, 11445, 11446, 11446, 11452, 11508, 11508, 11509, 11509, 11710, 11869, 11881, 12068, 12146, 12150, 12383, 13482, 13566, 13574, 13581

11775 (AD-A—184902/5/XAB) Investigation by differential scanning calorimetry of microstructure in a superplastic Al-Mg-Zr alloy. Master's thesis. Stewart, D.L. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1987. 90p. NTIS, PC A05/MF A01.

The three significant variables identified in thermomechanical processing of an A1-10Mg-0.1Zr alloy to obtain superplastic ductilities are reduction per pass, reheating time between passes, and total strain during warm rolling at 573K. The effect of adjusting these variables on elevated-temperature mechanical properties has been evaluated and the microstructures characterized using transmission electron microscopy. Comparison of the differential scanning calorimetry results with mechanical property and microstructural data reveal that the endothermic energy absorbed by the material, which is related to microstructural stability, can be correlated with superplastic behavior.

11776 **(AD-A—184944/7/XAB) Properties of refractory metals processed by enhanced sintering treatments. Final report.** German, R.M.; Farooq, S. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 29 May 1987. 8p. NTIS, PC A02/MF A01.

This investigation examined the sintering enhancement of refractory metals and attempted to link activator effects to sintering kinetics, microstructure, and properties. Work was carried out predominately on the W-Ni-Fe heavy-alloy system. In addition, it was recognized that property improvement in heavy alloys could be made possible by understanding impurity-microstructure interactions, fracture behavior, and finally the combined effect of processing conditions and materials characteristics on densification during liquid-phase sintering. This report addresses each of the above concerns and presents an overview of the work to date.

11777 **(AD-A—185161/7/XAB) Ductile two-phase alloys: prediction of strengthening at high strains.** Funkenbusch, P.D.; Lee, J.K.; Courtney, T.H. (Michigan Technological Univ., Houghton (USA). Dept. of Metallurgical Engineering). Jul 1987. 7p. NTIS, PC A02/MF A01.

Pub. in Metallurgical Transactions A, Vol. 18A, 1249-1256(Jul 1987).

When alloys containing two ductile phases are heavily deformed, composite-like microstructures develop and strengths well in excess of either of the phases in single-phase form may be exhibited as a result of microstructure/dislocation density effects. In this paper, a previously-published model for such strengthening is reviewed, and its application in a predictive capacity discussed. Flow stress vs fabrication strain data for the two components in single-phase from and for one two-phase alloy are necessary for this purpose. The model may then be applied to predict strength for any other two-phase alloy as a function of composition, fabrication strain, and interphase spacing. The approach is illustrated using existing data for several alloy systems. For Ag-Fe and Cu-Nb alloys (with very limited mutual solubility) strengths can be predicted within 15 to 20 pct of the experimental values over the entire range of strains and volume fractions for which data are available. In systems whre the potential for precipitation hardening exists (e.g., Cu-Fe) thermal history is important. When such hardening becomes a significant factor, the model cannot be used in its present form due to uncertainty over how to add the strengthening from this effect. Such hardening may, however, be useful in further improving the properties of these materials.

11778 **(AD-A—185216/9/XAB) Effect of rapid solidification on short-range order: a magnetic study. Final report, 1 April 1984-31 March 1987.** O'Handley, R.C. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 30 Jun 1987. 11p. NTIS, PC A03/MF A01.

In this study of the effects of rapid solidification on short-range order and magnetic properties, major progress and significant results were achieved in four specific areas. 1) Short-range order in Co80Nb/sub x/B/sub 20-x/ amorphous alloys was found to be similar at low x and dissimilar at large x to that of the equilibrium crystal structure. This key observation led to a broader model of magnetic properties in amorphous alloys. 2) Devitrification of two different metallic glasses led to technically and scientifically important discoveries related to the fine microstructures. 3) Theoretical cluster calculations of electronic structure significantly advanced understanding of bonding and magnetism in amorphous alloys. Finally, 4), it was found that magnetization reversal could be very well described by the soliton-like solutions to a realistic nonlinear wave equation. This approach correctly describes the coupling of the wall motion to its own local strain field, a technically important effect.

11779 **(AD-A—185228/4/XAB) Characterization of the corrosion behavior of high-damping alloys in seawater. Master's thesis.** Escue, W.D. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1987. 127p. NTIS, PC A07/MF A01.

Corrosion rates and the nature of corrosive attack were investigated for several high-damping alloys, including alloys based on the Cu-Mn, Fe-Cr-Al, Fe-Cr-Mo, Ti-Ni, and Cu-Zn-Al systems. Rates and modes of attack were determined for exposure of samples in synthetic and natural seawater. The results of potentiodynamic polarization and polarization resistance measurements made in the laboratory were compared with the results of actual sea exposures at the LaQue Center for Corrosion Technology, Wrightsville Beach, North Carolina. These results were used to make tentative recommendations with common aluminum alloys and steels in a marine environment. Overlays of independently determined potentiodynamic polarization plots for selected pairs of alloys were used to project theoretical corrosion rates in galvanic couples.

11780 **(AD-A—185393/6/XAB) Fundamental study of P/M processed elevated-temperature aluminum alloys. Final report, 1 October 1981-30 September 1986.** Lawley, A.; Koczak, M.J. (Drexel Univ., Philadelphia, PA (USA). Dept. of Materials Engineering). Jul 1987. 38p. NTIS, PC A03/MF A01.

Ambient and elevated-temperature tensile and creep response, and microstructural stability of a powder-processed Al-Fe-Ce alloy were evaluated. Gas-atomized Al-Fe-C was mechanically alloyed (MA) to give a volume fraction of dispersoids of about 0.23. The powder was isostatically pressed in aluminum cans, outgassed, and hot extruded to full density. Consistent with improved microstructural stability at elevated temperatures, the MA material is stronger and more creep-resistant than the non-MA material. These improvements are attributed to the presence of fine-scale oxides and carbides distributed uniformly throughout the structure, and which are introduced during MA; the dispersion inhibits coarsening, recovery, and recrystallization. Non-MA Al-Fe-Ce is stronger than non-MA Al-Fe-Ni at all temperatures but it has limited ductility. Qualitatively, the effect of MA on Al-Fe-Ce is similar to that in Al-Fe-Ni. These results suggest that Ce alters the transformation characteristics of Al-Fe and/or that Ce diffuses more slowly that Ni in Al, in the presence of Fe.

11781 **(AD-A—185440/5/XAB) Mechanical-property evaluation of a series of commercial tungsten alloys. Memorandum report.** Bruchey, W.J.; Montiel, D.M. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Jun 1987. 30p. (BRL-MR—3606). NTIS, PC A03/MF A01.

A series of commercially available tungsten alloys ranging in tungsten content from 75% to 95% were evaluated. Typical tensile and compressive engineering properties are reported. These tests were conducted in support of penetrator ballistic-test programs.

11782 **(BNL—40430) A review of pitting corrosion in high temperature aqueous solutions.** Cragnolino, G. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 84p. (CONF-870658—4). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003547/JAW.

From International conference on localized corrosion; Orlando, FL, USA (1 Jun 1987).

Pitting corrosion of metals and alloys in aqueous solutions containing aggressive anions at temperatures ranging from 100 to 300°C is reviewed. Following a discussion about reference electrodes and electrode potential scales, the effect of temperature on pitting and repassivation potentials is examined. Effects of alloy composition and environmental variables, such as nature and concentration of aggressive anions, inhibitors and pH, are discussed to emphasize the influence of temperature on the pitting corrosion behavior. Composition, structure and properties of passive films in high temperature aqueous solutions are briefly examined to explain how temperature affects the location of the attack and the pitting morphology. Existing models of pitting corrosion may not be suitable to explain the phenomenon at temperatures above 150 to 200°C, but are applicable at lower temperatures. 87 refs., 21 figs., 6 tabs.

11783 **(CEA-CONF—9119) Magnetic behavior in amorphous alloys Tb/sub x/Cu/sub 1-x/ (x= 0.18; 0.22; 0.33; 0.50; 0.65).** Boucher, B.; Sanquer, M.; Tourbot, R.; Chieux, P.; Convert, P.; Maret, M.; Bigot, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). Aug 1987. 13p. (CONF-870893—7). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751489/JAW.

From 6. international conference on rapidly quenched metals; Montreal, Canada (3 Aug 1987).

The results of susceptibility, magnetization and small angle neutron scattering measurement for 4 < T < 300K are discussed. The magnetic susceptibility in a 1.6 10/sup 5/ Am/sup -1/ field and the isothermal magnetization for each alloy have been measured for 4 < T < 300K; the magnetic properties are discussed in terms of the nuclear and magnetic medium range order as determined by small angle neutron scattering (SANS); the measurements were done at I.L.L. (Grenoble France) with the D11 spectrometer. The samples were prepared by sputtering and also, for x = 0.65, by planar flot casting (P.F.C). In the both cases the samples are in the form of sheets of 40μm thick and 1 cm wide. For sample x = 0.65 (PFC) both faces were polished with fine sand paper along a chosen direction and then measured.

11784 **(CEGB-TPRD/B—0907/R87) Role of phosphorus in the irradiation embrittlement of PWR pressure vessel steels.** Jones, R.B.; Buswell, J.T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1987. 40p. (PWR/RCC/MWG/P—86-62M). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751466/JAW.

An analysis has been performed of the influence of phosphorus on post-irradiation materials properties and microstructures determined on a variety of PWR steels and variants following exposure to MTR or reactor surveillance irradiations to doses not exceeding 7 x 10/sup 19/n.cm/sup -2/ (E>1.0MeV) at 250-290/sup 0/C. The irradiation-induced shifts in impact transition temperature, matrix hardening and the relative small angle neutron scattering response were found to rise most rapidly with increasing phosphorus when the copper content of the steel was 0.03 w/o. The sensitivity of the changes in mechanical properties to phosphorus content decreased as the copper content was increased. At copper levels typical of modern PWR steel manufacture (Cu<O.10w/o) both MTR and Surveillance data confirmed a significant detrimental effect on properties over the range 0.002 to 0.030w/o phosphorus. This was attributable to precipitation hardening, possibly by phosphide particles (M/sub 3/P) produced by the irradiation induced segregation of phosphorus to defect sinks and the depletion of phosphorus in solid solution as detected by high sensitivity electron microscopy and other analytical techniques. At higher levels of copper (approx. 0.3 w/o) the effect of phosphorus on properties was reduced by a factor of three due to the observed incorporation of phosphorus into the small copper precipitates formed during irradiation. Grain boundary embrittlement by phosphorus under irradiation is not thought to be important but further evidence concerning the post-irradiation fracture mode and the development of the deleterious influence of phosphorus with irradiation dose is required for a comprehensive understanding of its action. Some suggestions for future work are made.

11785 **(CONF-870893—6) Diffusion studies in amorphous NiZr alloys.** Hahn, H.; Averback, R.S.; Hoshino, K.; Rothman, S.J. (Argonne National Lab., IL (USA); Illinois Univ., Urbana (USA). Dept. of Materials Science and Engineering). Jun 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003009/JAW.

From 6. international conference on rapidly quenched metals; Montreal, Canada (3 Aug 1987).

Tracer impurity and self diffusion measurements have been made on amorphous (a-) NiZr alloys using radioactive tracer, Secondary Ion Mass Spectrometry and Rutherford backscattering techniques. The temperature dependence of diffusion in a-NiZr can be represented in the form D = D_0exp(-Q/kT), with no structural relaxation effects being observed. The mobility of an atom in a-NiZr increased dramatically with decreasing atomic radius of the diffusing atom and also with decreasing Ni content for Ni concentrations below ≈40 at. %. These diffusion characteristics in a-NiZr are remarkably similar to those in α-Zr and α-Ti. These mechanisms assume that Zr and Ti provide a close packed structure, either crystalline or amorphous, through which small atoms diffuse by an interstitial mechanism and large atoms diffuse by a vacancy mechanism. 12 refs., 2 figs., 2 tabs.

11786 **(CONF-871124—16) Application of Onsager's reciprocity relations to interface motion.** Kaplan, T.; Aziz, M.J.; Gray, L.J. (Oak Ridge National Lab., TN (USA); Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Nov 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003286/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

A requirement of any theory for the kinetics of interface motion during a phase transformation is that it satisfies Onsager's reciprocity relations. In this paper we show how to apply Onsager's relations to a phase transformation mediated by a moving interface in a two-component system. We use the result to evaluate two proposed models for interface motion during alloy solidification. 20 refs.

11787 **(CONF-8703215—) 3rd Aachen steel colloquium: Manufacture of iron and steel. Proceedings.** (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Eisenhuettenkunde; Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Bildsame Formgebung). 1987. 151p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751240/JAW.

From 3. Aachen steel colloquium (ASC-3): manufacture of iron and steel and exhibition; Aachen, F.R. Germany (19 Mar 1987).

The meeting was organised jointly by the 'Institute of Iron and Steelworking Technology' and the 'Institute of Metal Forming' at Aachen (FRG). Two large subject groups were dealt with: 1. Trends in development of pig iron production and 2. Modern steelworks technology. The volume about the meeting contains abstracts of the total of 22 lectures, two of which were included separately in the ENERGY data base.

11788 **(CONF-8705226—1) Positron-annihilation 2D-ACAR studies of disordered and defected alloys.** Bansil, A.; Prasad, R.; Smedskjaer, L.C.; Benedek, R.; Mijnarends, P.E. (Northeastern Univ., Boston, MA (USA). Dept. of Physics; Argonne National Lab., IL (USA); Netherlands Energy Research Foundation, Petten). Sep 1987. Contract W-31109-ENG-38. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003118/JAW.

From U.S.-Japan seminar on electronic structure and lattice defects in alloys; Honolulu, HI, USA (4 May 1987).

Theoretical and experimental progess in connection with 2D-ACAR positron annihilation studies of ordered, disordered, and defected alloys is discussed. We present, in particular, some of the recent developments concerning the electronic structure of disordered alloys, and the work in the area of annihilation from positrons trapped at vacancy-type defects in metals and alloys. The electronic structure and properties of a number of compounds are also discussed briefly; we comment specifically on high T/sub c/ ceramic superconductors, Heusler alloys, and transition-metal aluminides. 58 refs., 116 figs.

11789 (CONF-8706187—, pp 69-76) **Ratchetting behavior of Type 304 stainless steel at room and elevated temperature.** Ruggles, M.; Krempl, E. (Rensselaer Polytechnic Institute, Troy, NY). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

The zero-to-tension ratchetting behavior was investigated under uniaxial loading at room temperature and at 550, 600 and 650°C. In History I the stress level of ratchetting was equal to the stress reached at 1% strain. For History II the stress level was established to be the stress reached after a 2100 s relaxation at 1% strain. Significant ratchetting was observed for History I at room temperature but not at the elevated temperatures. The accumulated

ratchet strain increases with decreasing stress rate. For History II no ratchet strain was observed at room temperature independent of the stress rates used. This observation is explained in the context of the viscoplasticity theory based on overstress by the exhaustion of the viscous contribution to the stress during relaxation. The viscous part of the stress is the driving force for the ratchetting in History I. Strain aging is presumably responsible for the lack of short-time inelastic deformation resulting in a nearly rate-independent behavior at the elevated temperatures.

11790 (CONF-8706187—, pp 85-92) **Developing diagnostic methods for plasma-particle interaction.** Shaw, C.B. Jr. (Idaho National Engineering Lab., Idaho Falls). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Three diagnostic methods for study of plasma-particle interactions are described. The first, the single-line method of emission spectroscopy for measurement of plasma temperature, is well established but required careful implementation of automatic methods for data reduction and analysis, and will need to be extended at a later date. The second, laser-induced fluorescence (LIF) for measurement of density of species vaporized from the particles, has been found to require substantial modification in experimental detail and data analysis from its origin in flame diagnostics. The third, Doppler-shifted Rayleigh scattering for direct measurement of plasma velocity, is a new undertaking suggested by a single published report of successful measurements on a very high current arc.

11791 (CONF-8706187—, pp 93-99) **High temperature particle processing.** Elliott, J.F.; Spjut, R.E.; Bolsaitis, P. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

An apparatus has been designed, built, and placed in operation that permits study of gas-particle reactions and physical and chemical changes that take place when a particle is heated and cooled rapidly. The time resolution for an experiment is approximately 1 millisecond, and the possible temperature range for the experiments is between 1100 and 4000 degrees K. The particle is supported in the reactor by the interaction of an electrical charge on the particle and a vertically oriented DC potential. The particle is heated with a 20 w CO_2 laser, and the system is designed to process the particle for conditions simulating those encountered by a particle in passing through the flame of a thermal plasma. Experiments are in progress on phase transformations that may occur on heating and cooling of alumina, silica, carbonized alumina, iron-nickel alloys, and the ignition and burning of various types of carbon. The program includes work on problems encountered in measuring the temperatures of small particles that are being heated and cooled rapidly at rates of up to 1 million degrees per second, and where there are phase changes in a material.

11792 (CONF-8706187—, pp 161-167) **Instrumentation, measurement, and analyses for controlling residual stresses and metal movement in weldments - especially reducing joint mismatch and forces acting on tack welds during butt welding.** Chang, I.; Miyachi, H.; Masubuchi, K. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A basic concept of in-process control of residual stresses and distortion in weldments is presented. Significant reductions of residual stresses and distortion can be achieved by taking proper actions during welding while plastic strains are being formed. As an example of in-process control, experimental and analytical studies were made of reducing the opening of the root gap during gas metal arc welding of butt joints. The objective of the research was to reduce forces acting on tack welds so that a number of tack welds that act as major disturbances can be reduced or even eliminated. It has been found that additional heating by a set of oxyacetylene torches alongside the welding arc can produce thermal stresses that reduce the root gap opening. The optimum heating condition is to heat a wide region at relatively low temperatures.

11793 (CONF-8706187—, pp 168-175) **Sensing and modelling of gas metal arc welding.** Smartt, H.B.; Johnson, J.A.; Allemeier, R.T.; Carlson, N.M.; Einerson, C.J.; Watkins, A.D. (Idaho National Engineering Lab., Idaho Falls). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Welding automation is normally concerned with directly controlling such factors as current, arc voltage, travel speed, and filler wire speed. Several other levels of control can be identified beyond present technology including control of weld heat input, cooling rate, and bead geometry (bead width, penetration, reinforcements, and defects). The development of a steady-state model of the gas metal arc (GMA) welding process which allows independent control of the heat and mass input to the base metal is described. An electro-optical technique for measurement of the welding pool and groove geometry is also described along with an ultrasonic method for sensing the weld bead.

11794 (CONF-8706187—, pp 176-183) **Visible light emissions during gas tungsten arc welding and its application to weld image improvement.** Kim, E.W.; Allemand, C.; Eagar, T.W. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

An experimental study was carried out to map the light emissions from gas tungsten arc using 24 combinations of weld parameters. Data were collected with a computer interfaced double monochromatic imaging system. The intensity scale was calibrated throughout the wavelength rate from 488 nm to 730 nm using a spectral radiance standard lamp which is traceable to NBS standards. Lines were identified by element and wavelength with 0.065 nm wavelength resolution. The effect of intensity calibration was found to be very important in terms of comparing spectral maps and intensities. The emissions were found to be dramatically different with different shielding gases, welding current and base metals. Spectral windows were also determined. An improved image of the weld puddle can be obtained by operating within these spectral windows. Two dimensional distributions of major elements in an arc plasma are also presented and the anode spot on the molten weld surface was observed.

11795 (CONF-8706187—, pp 184-197) **Non-linearities in welding system dynamics.** Hardt, D.E.; Doumanidis, C.; Hale, M. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

The task of controlling welding is one that involves a multivariable and multi-energy domain process. Most work in this area has been directed at the development of sensing methods and related control systems for single variable, low bandwidth operation. The system dynamics of the process is presented in a pair of comprehensive models for the control of pool geometry and for the control of thermal history during gas metal arc welding. Through physically based modelling of these two aspects of the process, the full non-linear models are developed. In the case of the geometry, the model is derived from known behavior of the arc, approximations as to pool development and a simple heat transfer analysis of the weldment. The thermal problem is developed through a numerical analysis that includes accurate representations of material properties and heat transfer mechanisms involved. In this case, experimental verification was obtained. In both cases the non-linear models are reduced to equivalent linear transfer functions, and these are shown to be non-stationary, with a strong dependence on the operating point. These findings have strong implications for the method of control of multivariable systems, and their ultimate performance.

11796 **(CONF-8707132—1) Characterization of duplex stainless steels by TEM [transmission electron microscopy], SANS [small-angle neutron scattering], and APFIM [atom-probe field ion microscopy] techniques.** Chung, H.M.; Chopra, O.K. (Argonne National Lab., IL (USA)). Jun 1987. Contract W-31109-ENG-38. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002916/JAW.

From Symposium on characterization of advanced materials; Monterey, CA, USA (27 Jul 1987).

Results are presented of complementary characterization of aged duplex stainless steels by advanced metallographic techniques, including transmission and high-voltage electron microscopies; small-angle neutron scattering; and atom-probe field ion microscopy. On the basis of the characterization, the mechanisms of aging embrittlement have been shown to be associated with the precipitation of Ni- and Si-rich G phase and Cr-rich α' in the ferrite, and $M_{23}C_6$ carbides on the austenite-ferrite phase boundaries. 19 refs., 19 figs., 1 tab.

11797 **(CONF-8710111—14) Long-term aging of cast stainless steels: Mechanisms and resulting properties.** Chopra, O.K.; Chung, H.M. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002888/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

Mechanical property data are presented from Charpy-impact, tensile, and J-R curve tests for several heats of cast stainless steel aged up to 10,000 h at 450, 400, 350, 320, and 290°C. The results indicate that thermal aging increases the tensile strength and decreases the impactenergy, J/sub IC/ and tearing modulus of the steels. Also, the ductile-to-brittle transition curve shifts to higher temperatures. The low-carbon CF-3 steels were the most resistant and the molybdenum-containing high-carbon CF-8M steels were the most susceptible to low-temperature embrittlement. The influence of nitrogen content and distribution of ferrite on loss of toughness are discussed. Data also indicate that existing correlations do not accurately represent the embrittlement behavior over the temperature range 280 to 450°C, i.e., extrapolation of high-temperature data to reactor temperatures may not be valid for some compositions of cast stainless steels. 13 refs., 13 figs., 2 tabs.

11798 **(CONF-8710216—1) Oxidation-sulfidation behavior of Ni aluminide in oxygen-sulfur mixed-gas atmospheres.** Natesan, K. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003050/JAW.

From Symposium on high-temperature materials chemistry; Honolulu, HI, USA (18 Oct 1987).

Oxidation-sulfidation studies were conducted with sheet samples of nickel aluminide, containing 23.5 at. % Al, 0.5 at. % Hf, and 0.2 at. % B, in an annealed condition and after preoxidation treatments. Continuous weight-change measurements were made by a thermogravimetric technique in exposure atmospheres of air, a low-P/sub O_2/ gas mixture, and low-P/sub O_2/ gas mixtures with several levels of sulfur. Corrosion product scale layers were analyzed. Air-exposed specimens developed predominantly nickel oxide; the specimen exposed to a low-P/sub O_2/ environment developed an aluminum oxide scale. As the sulfur content of the gas mixture increased, the alumina scale exhibited spallation and the alloy tended to form nickel sulfide as the reaction phase. Results indicated that the sulfidation reaction of nickel aluminide specimens was determined by the rate of transport of nickel from the substrate through the scale to the gas/alumina scale interface, the mechanical integrity of the oxide scale, and the H_2S concentration in the exposure environment. 6 refs., 8 figs., 3 tabs.

11799 **(DNV/C—850222) Development of steel plate requirements for fixed offshore structures. Part 2. Draft report.** (Det Norske Veritas (Canada) Ltd.). 22 Feb 1985. 56p. (MICROLOG—85-6076). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Development of Canada's Arctic and East Coast oil and gas reserves will require more than 400,000 tons of Arctic grade plate during the next decade. Traditionally, the quality level has been met with normalized steel; however, it may be possible to supply this market with more weldable, lower cost, controlled rolled plate. Stelco is participating in a CANMET sponsored project to demonstrate the ability to provide this quality level. The strength and toughness of trial plates at each thickness in the controlled rolled and normalized condition were compared with tentative Arctic grade specifications. Each plate was checked for ultrasonic cleanliness, and the Z-direction ductility determined. A review of the literature on the metallurgy of controlled rolled plates and recommendations to improve the toughness of heavy plate are presented. 24 figs., 11 tabs.

11800 **(DOE/ER/45310—5) Some present limitations on the lattice imaging of grain boundaries.** Mader, W.; Necker, G.; Balluffi, R.W. (Massachusetts Inst. of Tech., Cambridge (USA)). 8 Sep 1987. Contract FG02-87ER45310. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87014665/JAW.

Limitations which currently exist on using the electron microscope lattice imaging technique to obtain information about grain boundary structure are considered. Boundaries are only amenable when the adjoining crystals are oriented so that they produce projected patterns of resolved atomic columns or atomic planes. The conditions under which information can then be obtained about the atomistic core structure, the boundary translational state and the presence of localized grain boundary dislocations are described. In a number of instances, ultra-thin bicrystals are required which are probably too thin to be prepared and utilized on a practical basis. 6 refs., 4 figs., 1 tab.

11801 **(IAE—4331/11) Study of activationless reactions of point defects with impurities and impurity-defect complexes in α-iron.** Kevorkyan, Yu.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701028/JAW.

Using the method of molecular dynamics, instability region of intrinsic interstitial atom near the complex impurity-vacancy in α-iron is investigated. A great number of impurity atoms of substitution differing in the volumetric change, which they introduce into crystal, is considered. The effect of impurities on dimensions of the Frenkel couple recombination region is evaluated. Spatial positions of interstitial atoms and substitution impurities with a small volume, at which spontaneous replacement of the latter from lattice point to one of stable interstitial positions of matrix is realized, are determined. Certain peculiarities of recombination of mixed dumbbell-like and other interstitial configurations of impurity are considered. 10 refs.; 4 tabs.

11802 **(IAEA-R—3894-F) Positron annihilation study of radiation damage in neutron-irradiation zirconium alloys. Final report for the period 15 August 1984 - 30 November 1986.** Sob, M. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie). (International Atomic Energy Agency, Vienna (Austria)). Oct 1987. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701043/JAW.

The radiation damage caused by determined fluences of fast neutrons, under closely controlled irradiation conditions, was measured on zirconium and its alloys. The irradiation was performed in helium atmosphere at three temperatures (60, 300 and 450 deg. C) in the NRI REZ research reactor. The radiation effects were studied using the angular correlation positron annihilation technique. Pure zirconium, and two of its alloys, with niobium iron, copper and molybdenum, were investigated. The results indicate that there is a pronounced effect of irradiation temperature: a noticeable smaller amount of vacancies and small clusters formed at higher temperatures. There is also a strong effect of alloying elements; if the added components consist of atoms with similar size as the host metal, the positron annihilation parameters change only little. Larger differences are observed in multicomponent alloys where the size of the atoms differ to a larger extent; it is suggested that in such material the zirconium self-interstitials are trapped by undersized solute atoms and/or by dislocations which results in a higher concentration of vacancies. 15 refs, 3 figs, 2 tabs.

11803 **(JINR-E—8-86-103) Long-time tunneling in amorphous metals at helium temperatures.** Kolac, M.; Neganov, B.S.; Sahling, A.; Sahling, S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701150/JAW.

Submitted to the journal J. Low Temp. Phys. .

Long-time heat release in amorphous Co/sub 69/Fe/sub 4.5/Cr/sub 2.5/B/sub 22/ and Fe/sub 80/B/sub 14/Si/sub 6/ after cooling from T/sub 1/ (3.12 K ≦ T/sub 1/ ≦ 292 K) to T/sub 0/ =1.3 K was measured. The power released is proportional to t/sup -1/ (0.5 h < t < 60 h). At low T/sub 1/ the experimental results are in good agreement with the standard tunneling theory. The resulting densities of states of two-level systems are close to those in quartz glass. For higher T/sub 1/, observed heat release may be explained assuming the existence of a maximum energy in the distribution function. 24 refs.; 6 figs.

11804 **(Juel-Conf—56) International workshop on the 'Physics of interfaces by synchrotron radiation and other high energy probes'.** Krummacher, S.; Gudat, W. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). May 1986. 56p. (CONF-8604376—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751295/JAW.

From International workshop on physics of interfaces by synchrotron radiation and other high energy probes; Bad Honnef, F.R. Germany (21 Apr 1986).

The present 'book of abstracts' consists of the abstracts of 23 lectures, held at the international workshop on the 'Physics of interfaces by synchrotron radiation and other high energy probes', April 1986, Bad Honnef, FRG. The subjects are: The use of photoemission in the study of interfaces and adsorbates, EEL spectroscopy applications, spin polarization, photoionization processes and EXAFS. (BHO).

11805 **(LBL—23853) Influence of post-anneal cooling treatments on suppression of cryogenic intergranular fracture in experimental Ni-free high-Mn austenitic steels.** Strum, M.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Aug 1987. Contract AC03-76SF00098. 20p. (CONF-8706125—21). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002766/JAW.

From Conference on advances in cryogenic engineering; St. Charles, IL, USA (14 Jun 1987).

The influence of thermal history on the grain boundary chemistries and cryogenic mechanical properties of two high-Mn austenitic steels are examined. While high-Mn alloys with excellent toughness at 4K have been developed, the Ni-free high-Mn alloys are susceptible to cryogenic intergranular embrittlement. Both the source of this embrittlement and the conditions necessary for its control have remained poorly understood. In quaternary Fe-30Mn-5Cr-0.16N and Fe-30Mn-5Cr-0.22N alloys the cryogenic toughness is strongly dependent on cooling rate. The 77K Charpy impact toughness of Fe-30Mn-5Cr-0.16N increases with decreasing cooling rate from 41 J after a brine-quench to 183 J after air-cooling. The influence of post-quench isothermal tempering treatments between 723 and 1023K on the impact toughness is also measured. The grain boundary chemistries of brine-quenched and air-cooled samples were examined by Auger electron spectroscopy. No grain boundary segregation of Mn is observed but both N and slight Cr enrichments are present. While no segregation of common embrittling species occurs, boron segregates to the grain boundaries during slow-cooling. 13 refs., 2 figs., 6 tabs.

11806 **(N—88-10940) Effect of sulfur and zirconium Co-doping on the oxidation of NiCrAl.** Smialek, J.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1987. 18p. (NASA-TM—100209; E—3814; NAS—1.15:100209; CONF-871027—). NTIS, PC A03/MF A01.

From 172. meeting of the Electrochemical Society; Honolulu, HI, USA (18 Oct 1987).

The adhesion behavior of Al_2O_3 scales formed on NiCrAl+Zr alloys was examined as a function of both sulfur and zirconium doping levels. In general, very high levels of zirconium were required to counteract the detrimental effects of sulfur. A sulfur-zirconium adherence map was constructed, as determined from the oxidation and spalling behavior in 1100 C cyclic tests. For low sulfur alloys, the amount of zirconium required for adherence at any given sulfur level can be described by Zr greater than 600 S sup 0.2 (in ppma). These results underscore the importance of sulfur to adhesion mechanisms and suggests that sulfur gettering is a first order effect of reactive element additions to MCrAl alloys.

11807 **(N—88-11140, pp vp) Constitutive modeling of superalloy single crystals with verification testing.** Jordan, E.; Walker, K.P. (Engineering Science Software, Inc., Smithfield, RI). Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The goal is the development of constitutive equations to describe the elevated temperature stress-strain behavior of single crystal turbine blade alloys. The program includes both the development of a suitable model and verification of the model through elevated temperature-torsion testing. A constitutive model is derived from postulated constitutive behavior on individual crystallographic slip systems. The behavior of the entire single crystal is then arrived at by summing up the slip on all the operative crystallographic slip systems. This type of formulation has a number of important advantages, including the prediction orientation dependence and the ability to directly represent the constitutive behavior in terms which metallurgists use in describing the micromechanisms. Here, the model is briefly described, followed by the experimental set-up and some experimental findings to date.

11808 **(N—88-11140, pp vp) Constitutive modeling for isotropic materials.** Ramaswamy, V.G.; Vanstone, R.H.; Dame, L.T.; Laflen, J.H. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

Constitutive theories were evaluated against a large uniaxial and multiaxial data base that was generated as part of this work. The experimental approach was to determine the constitutive behavior of Rene 80 under a multitude of conditions that are important in the design of gas turbine blades and vanes. The experimental and analytical goals of this program were successfully accomplished. A new multiaxial constitutive model which can represent the complex nonlinear high temperature behavior of Rene 80 was developed. The model was extensively verified on data at several temperatures.

11809 **(N—88-11140, pp vp) Elevated temperature crack growth.** Malik, S.N.; Vanstone, R.H.; Kim, K.S.; Laflen, J.H. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The purpose is to determine the ability of currently available P-I integrals to correlate fatigue crack propagation under conditions that simulate the turbojet engine combustor liner environment. The utility of advanced fracture mechanics measurements will also be evaluated during the course of the program. To date, an appropriate specimen design, a crack displacement measurement method, and boundary condition simulation in the computational model of the specimen were achieved. Alloy 718 was selected as an analog material based on its ability to simulate high temperature behavior at lower temperatures. Tensile and cyclic tests were run at several strain rates so that an appropriate constitutive model could be developed. Suitable P-I integrals were programmed into a finite element post-processor for eventual comparison with experimental data.

11810 **(N—88-11140, pp vp) Life prediction and constitutive models for engine hot section anisotropic materials program.** Swanson, G.A. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The purpose is to develop life prediction models for coated anisotropic materials used in gas temperature airfoils. Two single crystal alloys and two coatings are now being tested. These include PWA 1480; Alloy 185; overlay coating, PWA 286; and aluminide coating, PWA 273. Constitutive models are also being developed for these materials to predict the plastic and creep strain histories of the materials in the lab tests and for actual design conditions. This nonlinear material behavior is particularly important for high temperature gas turbine applications and is basic to any life prediction system.

11811 (N—88-11140, pp vp) **Creep-fatigue behavior of NiCoCrAlY coated PWA 1480.** Miner, R.V.; Gayda, J.; Hebsur, M.G. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

This study of high-temperature fatigue and creep-fatigue behavior is part of a program to identify the basic features of the effects of temperature, creep, fatigue, and environment on the behavior of a single crystal superalloy, a bulk coating alloy, and a coated alloy system. A system was selected which has had considerable production experience: the Ni-base superalloy, PWA 1480, and the NiCoCrAlY coating, PWA 276. Isothermal behavior was studied first. A series of fatigue and creep fatigue tests of the types commmonly designated as pp, cp, pc and cc were conducted. These tests were conducted at various constant total strain ranges. The creep-fatigue cycles employed constant stress dwells at the maximum and/or minimum load. Test results are given.

11812 (N—88-11140, pp vp) **Turbine airfoil deposition models and their hot corrosion implications.** Rosner, D.E.; Nagarajan, R. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

This research project deals with the prediction of single- and multi-component salt(-solution) deposition, flow and oxide dissolution and their effects on the lifetime of turbine blades. Goals include rationalizing and helping to predict corrosion patterns on operational gas turbine (GT) rotor blades and stator vanes, and ultimately providing some of the tools required to design laboratory simulators and future corrosion resistant high-performance engines. Necessary background developments are reviewed. Results and tentative conclusions for single species (Na_2SO_4(l)) condensation, binary salt-solution (Na_2SO_4-K_2SO_4) condensation, and burner-rig testing of alloy materials are outlined.

11813 (N—88-11140, pp vp) **Effects of surface chemistry on hot corrosion life.** Fryxell, R.E.; Leese, G.E. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

This program has as its primary objective: the development of hot corrosion life prediction methodology based on a combination of laboratory test data and evaluation of field service turbine components which show evidence of hot corrosion. The laboratory program comprises burner rig testing by TRW. A summary of results is given for two series of burner rig tests. The life prediction methodology parameters to be appraised in a final campaign of burner rig tests are outlined.

11814 (N—88-11140, pp vp) **Coating life prediction.** Nesbitt, J.A.; Gedwill, M.A. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The investigation combines both experimental studies and numerical modeling to predict coating life in an oxidizing environment. The experimental work provides both input to and verification of two numerical models. The coatings being examined are an aluminide coating on Udimet 700 (U-700), a low-pressure plasma spray (LPPS) Ni-18Co-17Cr-24Al-0.2Y overlay coating also on U-700, and bulk deposits of the LPPS NiCoCrAlY coating.

11815 (N—88-11140, pp vp) **Thermal expansion mismatch and oxidation in thermal barrier coatings.** Chang, G.C.; Phucharoen, W.; Miller, R.A. (Cleveland State Univ., OH). Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

Thermal barrier coatings (TBC) for advanced gas turbine blades have been under intensive development during the last several years. This investigation is intended to achieve a clearer understanding of the mechanical behavior of plasma sprayed zirconia-yttria TBCs, involving a nickle-chromium-aluminum bond coat. The near term objectives are to study the stress states in a relatively simple model TBC subjected to steady state thermal loading. The resulting thermal expansion mismatch and oxidation have been primary targets for the study. The finite element approach and the effects of thermal mismatch and oxidation are described. A proposed mechanism for oxidation induced coating failure is also presented.

11816 (N—88-11140, pp vp) **Thermal barrier coating life prediction model development.** Strangman, T.E.; Neumann, J.F.; Tasooji, A. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

This program focuses on predicting the lives of two types of strain-tolerant and oxidation-resistant thermal barrier coating (TBC) systems that are produced by commercial coating suppliers to the gas turbine industry. The plasma-sprayed TBC system is composed of a low pressure, plasma sprayed applied, oxidation resistant NiCrAlY bond coating. The other system is an air plasma sprayed yttria (8 percent) partially stabilized zirconia insulative layer.

11817 (N—88-11140, pp vp) **Thermal barrier coating life prediction model development.** Hillery, R.V.; Pilsner, B.H.; Duderstadt, E.C. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objectives are to determine the predominant modes of degradation of a plasma sprayed thermal barrier coating system, and then to develop and verify life prediction models accounting for these degradation modes. Two possible predominant failure mechanisms being evaluated are bond coat oxidation and bond coat creep.

11818 (N—88-11140, pp vp) **Thermal barrier coating life prediction model development.** Demasi, J.T.; Sheffler, K.D. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective is to develop an integrated life prediction model accounting for all potential life-limiting thermal barrier coating (TBC) degradation and failure modes, including spallation resulting from cyclic thermal stress, oxidation degradation, hot corrosion, erosion and foreign object damage.

11819 (ND-R—1400(R)) **Corrosion studies on mild steel in contact with cemented waste forms.** Platts, N. (UKAEA Risley Nuclear Power Development Labs.). (UKAEA Risley Nuclear Power Development Establishment). Mar 1987. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751469/JAW.

The internal corrosion of mild steel drums has been assessed in support of the proposed cementation of low level solid and sludge wastes arising from the Winfrith SGHWR. General corrosion rates are expected to be very low but while oxygen is present pitting, at least in principle, is possible. Passive currents for mild steel in contact with the different cement formulations have therefore been determined, thereby enabling the timescale for residual oxygen within the drums to be assessed. These measurements indi-

cate that for BFS/OPC cement formulations the oxygen will be exhausted within 37 days, though potential monitoring suggests that sulphides present in the cement may reduce this figure. For PFA/OPC cement formulations the passive currents suggest that it would take ca. one year for the oxygen present in a drum to be exhausted. Therefore though pitting should not be a problem with the BFS/OPC cement formulations, further investigation of the extent of pitting that may occur in the PFA/OPC waste form is desirable.

11820 **(NP—8750999) Reproducible removal of geometrically defined volumes with laser beams. Final report.** Treusch, H.G.; Hopf, W.; Knoff, M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Angewandte Physik). Oct 1985. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88750999/JAW.

Processing speeds in excess of 10/sup 3/ cm/s for material removal using laser beams also include in the process sequence the plasma formation in the evaporated material and increased melt dynamics. The influcence of the plasma and melt dynamics on the geometry and the reproducibility of the material removal is dealt with in this report. Starting with an investigation of the absorption behaviour during the start phase of the material removal using laser beams, investigations are carried out at intensities abvoe the threshold for a laser-induced plasma in material vapor, on the influence of the plasma on the processing results and upon the controllability of the plasma by means of appropriate pulse formation. The aim of the project work was the improvement of the reproducibility of the geometry and quality of the material removal, referred to melt deposits in the fringe zone of injection nozzles and throttles, for propellants and fuels in automobiles and heating systems. 36 refs., 2 tabs., 57 figs.

11821 **(PB—88-853387/XAB) Welding: personnel safety. January 1966-November 1987 (citations from the Metals Abstracts data base). Report for January 1966-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 73p. NTISPC N01/MF N01.

Supersedes PB—85-865020.

This bibliography contains citations concerning health and occupational safety hazards encountered by welders. Research in foreign-substance production, respiratory health hazards, ocular hazards, injury to extremities, damage to property and equipment, and automatic welding and ergonomics are discussed. Safe work principles, safe weld design and proper materials, and equipment inspections are also discussed. Toxic-materials control is emphasized in another bibliography. (This updated bibliography contains 231 citations, 60 of which are new entries to the previous edition.)

11822 **(SAND—87-0093C) More observations on selectivity loss during tungsten CVD.** Creighton, J.R.; Rogers, J.W. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 8p. (CONF-8710225—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002639/JAW.

From Workshop on tungsten and other refractory metals for VLSI applications; Yorktown Heights, NY, USA (7 Oct 1987).

X-ray photoelectron spectroscopy (XPS) was used to investigate a mechanism for selectivity loss during tungsten CVD which involves the formation and disproportionation of tungsten subfluorides. The subfluorides were formed by flowing WF_6 over a tungsten foil held at 600 to 700°C causing a nearby room temperature SiO_2-covered silicon sample to become covered with a tungsten-fluorine compound. XPS analysis of this film revealed that the W(4d/sub 5/2/) electron binding energy was intermediate between that of metallic tungsten and WF_6, indicating the compound was a tungsten subfluoride. Upon heating to ≧500°C, the W(4d/sub 5/2/) electron binding energy shifted to 243.5 eV which is characteristic of metallic tungsten. Also, the F(1s) XPS intensity decreased to a very low level. Results corroborate earlier work indicating that such tungsten subfluoride overlayers disproportionate at ~300°C into WF_6 which desorbs, and metallic tungsten which remains on the surface. The metallic tungsten may then "catalyze" the hydrogen reduction of WF_6, thus initiating selectivity loss. 13 refs., 2 figs.

11823 **(SAND—87-1437C) Growth and electronic properties of strained metal overlayers.** Kellogg, G.L.; Houston, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 4p. (CONF-8706239—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE87010956/JAW.

From Basic energy sciences review; Albuquerque, NM, USA (17 Jun 1987).

Very detailed information relating to the growth and electronic properties of strained-metal overlayers has been obtained for Cu/Ru, Ni/Ru, and Ni/W. We are now in the process of extending these studies to other systems to examine the systematics of these properties. We are also attempting to correlate these properties with the observed chemical and catalytic behavior of the bimetallic systems. 4 refs., 2 figs.

11824 **(SAND—87-2039) Fatigue crack growth due to random loading.** Veers, P.S. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 163p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88004641/JAW.

Fatigue crack growth due to random loading is investigated, showing a variety of approaches that are tailored to the level of complexity required for the application at hand. The emphasis is on creating the simplest models, of both the crack growth process and the random loading, that maintain the desired level of accuracy. A new crack growth model, which combines some of the features of existing models, is introduced and shown to predict several sets of published test results. The model provides a means of approximating load sequence effects by continuously updating the crack opening stress, accounting for both acceleration and retardation effects in a simplified manner. This model is used as the standard crack growth model that includes sequence effects. 87 refs., 4 figs., 8 tabs.

11825 **(Y/DW—716) Detection of hydrogen-assisted-cracking in U-0.8Ti alloy weldments by acoustic emission monitoring.** Whittaker, J.W.; Richey, M.W. (Oak Ridge Y-12 Plant, TN (USA)). 3 Nov 1987. Contract AC05-84OS21400. 16p. (CONF-8703210—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003221/JAW.

From 7. interagency acoustic emission conference; Golden, CO, USA (31 Mar 1987).

Electron-beam weldments of U-0.8Ti alloys have demonstrated a sensitivity to hydrogen-assisted-cracking (HAC). A survey experiment was undertaken to determine if RH threshold value exists for HAC formation. Since long periods are often required for crack formation, a method was needed to determine when a crack(s) formed. Acoustic emissions monitoring was selected because of its sensitivity and adaptability to long-term monitoring. 1 ref., 5 figs., 3 tabs.

11826 **Mn local structure in the decagonal phase of Al-Mn alloys.** Bridges, F.; Boyce, J.B.; Dimino, G.M.; Giessen, B.C. (Department of Physics, University of California, Santa Cruz, Santa Cruz, California 95064). *Physical Review [Section] B: Condensed Matter;* **36**: No. 17, 8973-8978(15 Dec 1987).

Our extended x-ray absorption fine-structure (EXAFS) results on the decagonal phase of Al-Mn alloys indicate that each Mn atom has on average about eight Al neighbors in the first-neighbor peak, compared to ten in the icosahedral phase. The decrease in the number of neighbors occurs in the low-distance part of the radial distribution function. These differences between the icosahedral- and decagonal-phase nearest-neighbor pair distribution functions, p(r), correlate with the changes in the fraction of magnetic and nonmagnetic sites observed in NMR, suggesting that the sharper part of p(r) is nonmagnetic and the broader part magnetic. These results suggest a model based on Al pentagons or distorted MacKay icosahedra, elongated along a fivefold axis.

11827 **Spin-orbit-interaction-induced surface resonance on W(011).** Gaylord, R.H.; Kevan, S.D. (Physics Department and Materials Science Institute, University of Oregon, Eugene, Oregon 97403). *Physical Review [Section] B: Condensed Matter;* **36**: No. 17, 9337-9340(15 Dec 1987).

A surface resonance has been observed on the (011) surface of tungsten using angle-resolved photoemission. The resonance is located near the center of the surface Brillouin zone in a pseudogap opened by the spin-orbit interaction. It is degenerate with a bulk band, which in the absence of the spin-orbit interaction would have a different symmetry than a state in the gap. The resultant weak coupling leads to formation of a well-defined resonance. These conclusions are supported by polarization- and photon-energy-dependent studies. The generality of our observations is discussed.

11828 **Order-disorder transition of Au and Pt(110) surfaces: The significance of relaxations and vibrations.** Daw, M.S.; Foiles, S.M. (Sandia National Laboratories, Livermore, California 94550). *Physical Review Letters;* 59: No. 24, 2756-2759(14 Dec 1987).

The embedded-atom method has been combined with Monte Carlo simulations to study the structure and order-disorder transformation of Au and Pt(110) surfaces. We find that the missing-row structure of Au disorders at 570 K, in close agreement with the experimental value of 650 K. For Pt, we predict a transformation at 750 K. Relaxations and vibrations are found to be essential for the accurate calculation of the critical temperature.

11829 **Observaton of envelope solitons in solids.** Wu, J.; Wheatley, J.; Putterman, S.; Rudnick, A.I. (Physics Department, University of California, Los Angeles, California 90024). *Physical Review Letters;* 59: No. 24, 2744-2747(14 Dec 1987).

We have observed highly nonlinear localized wave packets propagating as flexural modes of thin shells. They maintain their structure in a collision and have envelopes in quantitative agreement with the soliton solutions to the nonlinear Schroedinger equation.

11830 **Roughening transition of a stepped Cu(113) surface: A synchrotron x-ray-scattering study.** Liang, K.S.; Sirota, E.B.; D'Amico, K.L.; Hughes, G.J.; Sinha, S.K. (Corporate Research Science Laboratories, Exxon Research and Engineering Company, Annandale, New Jersey 08801). *Physical Review Letters;* 59: No. 21, 2447-2450(23 Nov 1987).

The study of the roughening transition of a stepped surface of Cu(113) has been performed with the use of synchrotron grazing-incidence x-ray scattering. Surface roughening was observed directly from x-ray scans of the step superlattice reflection between 300 and 750 K. The results are interpreted with a theory of Villain, Grempel, and Lapujoulade, and the values of the transition temperature, the step-step repulsive energy, and the kink energy are determined to be 620 +- 10 K, 7.4 +- 0.9 meV, and 181 +- 6.5 meV, respectively.

11831 **Electronic structure of disordered CuPd alloys: A two-dimensional positron-annihilation study.** Smedskjaer, L.C.; Benedek, R.; Siegel, R.W.; Legnini, D.G.; Stahulak, M.D.; Bansil, A. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* 59: No. 21, 2479-2482(23 Nov 1987). Contract W-31-109-ENG-38.

Two-dimensional—angular-correlation experiments using posi- tron-annihilation spectroscopy were performed on a series of disordered Cu-rich CuPd-alloy single crystals. The results are compared with theoretical calculations based on the Korringa-Kohn-Rostoker coherent-potential approximation. Our experiments confirm the theoretically predicted flattening of the alloy Fermi surface near [110] with increasing Pd concentration. The momentum densities and the two-dimensional—angular-correlation spectra around zero momentum exhibit a characteristic signature of the electronic states near the valence-band edge in the alloy.

11832 **Magnetoresistive effects in the upper critical fields of heavy-fermion superconductors.** DeLong, L.E.; Crabtree, G.W.; Hall, L.N.; Hinks, D.G.; Kwok, W.K.; Malik, S.K. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* 36: No. 13, 7155-7158(1 Nov 1987).

The magnetoresistances Δrho of U_6Fe, U_6Co, and UPt_3 have been measured and found to follow a novel, universal behavior at low temperatures. The Δrho data have been used to create the first quantitative model of the anomalous critical fields H/sub c/$_2$ of these compounds. An empirical analysis suggests that H/sub c/$_2$ and T/sub c/ are limited by a low-energy scale T_0 that is comparable to the coherence temperature and related to the T^2 coefficient of electrical resistivity. These results point to the existence of a novel pairing interaction that persists over a broad range of fermion-mass ratios 10approx. <m/sup *//m/sub e/approx. <100. .AE

11833 **The corrosion behavior of molybdenum and Hastelloy B in sulfur and sodium polysulfides at 623 K.** Brown, A.P. (Chemical Technology Div., Argonne National Lab., Argonne, IL 60439). *Journal of the Electrochemical Society;* 134: No. 8A, 1921-1924(Aug 1987). Contract W-31-109-ENG-38.

An experimental study was completed to determine the corrosion behavior of molybdenum and Hastelloy B, a nickel-based alloy with high molybdenum content, in sulfur and sodium polysulfides (Na/sub 2/S/sub 3/,Na/sub 2/S/sub 4/, Na/sub 2/S/sub 5/) at 623 K. In sulfur, molybdenum corrodes very slowly, with a parabolic rate constant of 3.6 x 10/sup -9/ cm s/sup -1/2/. Hastelloy B shows no measurable corrosion after 100h of exposure to sulfur. The corrosion reaction of molybdenum in Na/sub 2/S/sub 3/ is characterized by the formation of a protective film that effectively eliminates further corrosion after the first 100h of exposure. Hastelloy B, however, corrodes rapidly in Na/sub 2/S/sub 3/, with corrosion rates approaching those of pure nickel under the same conditions. After the first 4h of exposure, the kinetics for the corrosion of Hastelloy B in Na/sub 2/S/sub 3/ follows a linear rate law. The scale morphology has multiple spalled layers of NiS/sub 2/, with some crystallites of NiS/sub 2/ appearing on the leading face of the scale and between the individual scale layers. This spalling causes smaller coupons of the Hastelloy B to corrode faster than larger coupons.

11834 **Application of ion implantation to the study of electrocatalysis. I. Chlorine evolution at Ru-implanted titanium electrodes.** Kelly, E.J.; Heatherly, D.E.; Vallet, C.E.; White, C.W. (Chemistry Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Journal of the Electrochemical Society;* 134: No. 7, 1667-1675(Jul 1987). Contract AC05-84OR21400.

Ru-implanted titanium near-surface alloys were generated by ion implantation, characterized (Ru concentration/depth profiles) by Rutherford backscattering, and subsequently anodically oxidized to form electrocatalytically active Ru/sub x/Ti/sub 1-x/O/sub 2// Ti electrodes. The electrochemical behavior of the metallic-like electrodes was investigated in acidic chloride, perchlorate, and sulfate media. A correlation between the rate of the Cl/sub 2/ evolution reaction and the Ru-implant profiles established that the reaction is first order in the concentration of Ru(IV) in the oxide at the oxide/solution interface, and enabled an in situ evaluation of the latter quantity. The Tafel slope for the Cl/sub 2/ evolution reaction is 40 mV, i.e. ∂ E/∂ log i = 2.303 (2RT/3F). The reaction order with respect to chloride ion concentration, ∂ log i/∂ log [Cl/sup -/], approaches 1.0 and 2.0 at high and low chloride concentrations, respectively. A modified Volmer-Heyrovsky mechanism, one in which the role of adsorbed chloride ions is taken into account, is shown to be consistent with the aforementioned diagnostic parameters.

11835 **The relationship between dealloying and transgranular stress-corrosion cracking of Cu-Zn and Cu-Al alloys.** Sieradzki, K.; Kim, J.S.; Cole, A.T.; Newman, R.C. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY 11973). *Journal of the Electrochemical Society;* 134: No. 7, 1635-1638(Jul 1987). Contract AC02-76CH00016.

Single crystals of various α-phase Cu-Zn and Cu-Al alloys have been tested for dealloying and stress-corrosion cracking (SCC) in cuprous ammonia solutions. All tests were done at the equilibrium potential of a copper electrode. The dealloying tests were done by scratching coated specimens and measuring the consequent anodic current transients, and the SCC tests used a constant extension rate. The rate of dealloying increased almost discontinuously

between 17 and 20 atom percent (a/o) Zn and between 11 and 16 a/o Al. These "parting limits" corresponded identically to the onset of transgranular SCC in both systems. The results support a percolation model of dealloying and a film-induced cleavage model for stress-corrosion cracking.

11836 **Effects of acidic deposition on the atmospheric deterioration of materials.** Lipfert, F.W. (Brookhaven National Lab., Bldg. 475, Upton, NY 11973). *Materials Performance;* 26: No. 7, 12-19(Jul 1987).

Interest in materials damage and corrosion has included the effects of acidic precipitation, in addition to the effects of gaseous and particulate air pollution. Assessing the relative importance of these usually additive effects requires damage functions, relating the loss of a given material to specific agents in the atmosphere. Some of these functions are linear, i.e., proportional to both pollutant concentrations and time; some are decidedly nonlinear. All have intercepts or constant terms that incorporate nonspecific deterioration effects, i.e, natural weathering. The relative importance of local vs regional air pollution or precipitation chemistry in this context requires the consideration of atmospheric transport as well as the linearity of the damage function. The location of pollution sources relative to population centers (where materials are also concentrated) is seen to be important in the overall assessment of costs and benefits of pollution control.

11837 **Metastable phase production and transformation in Al-Ge alloy films by rapid crystallization and annealing treatments.** Kaufman, M.J.; Cunningham, J.E. Jr.; Fraser, H.L. (Dept. of Materials Science and Engineering, FB-10, Univ. of Washington, Seattle, WA 98195). *Acta Metallurgica;* 35: No. 5, 1181(May 1987).

Metastable crystalline phases have been produced in Al-Ge alloy films which initially were either entirely or partially amorphous by rapid crystallization and subsequent annealing treatments. The studies were conducted directly in a transmission electron microscope where the electron beam was used as a local heating source to effect the reactions. The types and sequences of transformations are described and discussed in terms of competitive nucleation and growth kinetics. In addition, the results are related to those previously obtained on similar alloys subjected to rapid quenching and high undercooling treatments.

11838 **Long period superstructures in Ag/sub 3/Mg.** Kulik, J.; Takeda, S.; De Fontaine, D. (Univ. of California, Dept. of Physics, Berkeley, CA 94720). *Acta Metallurgica;* 35: No. 5, 1137-1148(May 1987).

One-dimensional long period superstructures have been studied by high resolution electron microscopy and electron diffraction. Several new polytypes have been found. A free energy model involving competing pair interactions is discussed for describing the configurational statistics of this system.

11839 **Nucleation of grain boundary cavities under the combined influence of helium and applied stress.** Al-Hajji, J.N.; Ghoniem, N.M. (Mechanical Engineering Dept., Univ. of Kuwait). *Acta Metallurgica;* 35: No. 5, 1067-1076(May 1987).

The role of stress in cavity nucleation is analyzed by taking into account grain boundary sliding to describe stress concentration buildup and relaxation at particles and triple-point junctions. Helium clustering in the matrix is modeled using rate theory. The helium flux to grain boundaries is determined by the application of sink strength theory which takes into account the various competing clustering mechanisms in the matrix. Helium clustering on grain boundaries is also theoretically investigated using rate theory. The work agrees with experimental observations showing that irradiation results in grain boundary bubble densities which are orders of magnitude larger than cavity populations in conventional creep experiments.

11840 **The strength, hardness and ductility of Ni/sub 3/Al with and without boron.** Weihs, T.P.; Zinoviev, V.; Viens, D.V.; Schulson, E.M. (Thayer School of Engineering, Dartmouth College, Hanover, NH 03755). *Acta Metallurgica;* 35: No. 5, 1109-1118(May 1987).

Experiments were performed to investigate the effects of grain size (2-1100 μm) and temperature (77-1023 K) on the strength, hardness and ductility of stoichiometric Ni/sub 3/Al with (0.35 at %) and without boron. The results show that grain refinement strengthens and hardens the alloys at low temperatures (< 873 K), but weakens them at high temperatures; lowers the magnitude of the anomalous thermal strengthening, leading to thermal weakening; and effects a "ductile to more ductile" transition in Ni/sub 3/Al+B at room temperature and a brittle to ductile transition in both alloys at elevated temperatures (≧ 673 K). Grain refinement has little effect on the room-temperature ductility of Ni/sub 3/Al and on the work hardening rate. The addition of boron hardens coarse-grained material but softens fine-grained aggregates. These results are explained in terms of deformation and fracture mechanisms.

11841 **Electron spectroscopy study of the heavy fermion compounds URu_2Si_2.** Allen, J.W.; Kang, J.-S.; Lassailly, Y.; Maple, M.B.; Torikachvili, M.S.; Ellis, W.; Pate, B.; Lindau, I. (Xerox Palo Alto Research Center, CA, USA; Xerox Palo Alto Research Center, CA, USA; California Univ., San Diego, La Jolla, USA. Dept. of Physics; California Univ., San Diego, La Jolla, USA. Inst. of Pure and Applied Physical Sciences; Xerox Palo Alto Research Center, CA, USA; California Univ., San Diego, La Jolla, USA. Dept. of Physics; Centre National de la Recherche Scientifique, 38 - Grenoble, France. Centre de Recherches sur les Tres Basses Temperatures; California Univ., San Diego, La Jolla, USA. Dept. of Physics; California Univ., San Diego, La Jolla, USA. Inst. of Pure and Applied Physical Sciences; Los Alamos National Lab., NM, USA; Stanford Univ., CA, USA. Stanford Synchrotron Radiation Lab.). *Solid State Communications;* 61: No. 3, 183-186(Jan 1987).

We report x-ray photoemission, resonant photoemission and bremsstrahlung isochromat spectra of the 4f core levels, the valence band and the conduction band, respectively, of the heavy fermion compounds URu_2Si_2. The resonant photoemission behavior of the uranium 5f weight resembles that of cerium 4f weight in that the portion away from the Fermi energy has a delayed resonance relative to that at the Fermi energy. We also assess current efforts to interpret uranium spectra.

11842 **Penetration depths of superconducting U_6X (X = Fe, Co, Mn).** Hou, M.K.; Huang, C.Y.; Olsen, C.E. (Los Alamos National Lab., NM, USA). *Solid State Communications;* 61: No. 2, 101-103(Jan 1987).

The penetration depths, lambda(T), of the heavy-fermion uranium-based superconductors U_6X (X = Fe, Co, Mn) have been measured as a function of temperature at approx. 35 MHz. It was found that the temperature dependence of lambda(T) for these compounds agrees well with the BCS theory. However, the values of lambda(0) are large. By comparing the Slater - Pauling curve of the X elements with $\text{lambda}(0)^{-1}$ for the U_6X superconductors, we have found that $\text{lambda}(0)^{-1}$ is proportional to the saturation spin moments of elemental X, suggesting that there is a correlation between the superconductivity of these U_6X superconductors and the magnetic nature of the X elements.

11843 **Self-interstitial atom interactions with defect clusters in Ag.** Dworschak, F.; Birtcher, R.C.; Averback, R.S. (Argonne National Lab., IL, USA). *Radiation Effects;* 100: No. 3-4, 313-322(Jan 1987).

Measurements of defect production rates during proton irradiations at 125 K have been used to probe the damage structure produced by protons or heavy ion irradiations. Electrical resistivity was used to monitor the probe damage rates. As the energy density of the displacement cascade increases, the probability of a probe interstitial annihilating with a vacancy within the cascade is reduced relative to its trapping at interstitial clusters. There is also a slight decrease in the average vacancy annihilation radius with increasing energy density in the cascades. During annealing, the relationship between annihilation and trapping probabilities remains constant throughout stage II, but in stage III, the annihilation probability decreases strongly. This annealing behavior was observed for all ion irradiations and is believed to be due to a reduction in the average

vacancy annihilation radius associated with the formation of vacancy loops.

11844 **Evolution of phase microstructure during irradiation.** Wiedersich, H. (Argonne National Lab., IL, USA). *Radiation Effects;* **101**: No. 1-4, 21-36(1987). (CONF-8506165—).

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

The phase microstructure of alloys is frequently severely altered during irradiation. Sluggish precipitation reactions including precipitation coarsening are accelerated by irradiation-enhanced diffusion. Radiation-induced segregation redistributes existing precipitate phases within the microstructure, induces precipitation of nonequilibrium phases and affects the composition of phases in multicomponent alloys. The displacement process causes disordering of ordered alloys and frequently amorphization, especially in intermetallic compounds, at low temperature. Although a good qualitative understanding of the basic process involved, i.e., displacement mixing, radiation-enhanced diffusion and radiation-induced segregation exists, methods for detailed quantitative modeling of the evolution of the microstructure of alloys remain to be developed.

11845 **New developments in irradiation-induced microstructural evolution of austenitic alloys and their consequences on mechanical properties.** Garner, F.A.; Brager, H.R.; Hamilton, M.L.; Dodd, R.A.; Porter, D.L. (Westinghouse Hanford Co., Richland, WA, USA; Wisconsin Univ., Madison, USA; Argonne National Lab., Idaho Falls, ID, USA). *Radiation Effects;* **101**: No. 1-4, 37-53(1987). (CONF-8506165—).

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

A survey is presented of recent developments in the study of radiation-induced changes in the microstructure of austenitic structural alloys that occur in fission reactors. The associated macroscopic consequences of these changes on both mechanical properties and dimensional stability are also reviewed. It is anticipated that some changes will occur in these phenomena as a result of the differences inherent in fission and fusion neutron spectra, but relevant data obtained to date do not indicate that the effects of helium and several other transmutation-related differences will be large.

11846 **Tensile properties of V-15Cr-5Ti following neutron irradiation and helium implantation.** Grossbeck, M.L.; Horak, J.A. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **101**: No. 1-4, 169-171(1987). (CONF-8506165—).

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

Because of their high melting point and low neutron activation properties, vanadium alloys have been considered for use as a fusion first wall material. The fusion environment produces helium in most common structural alloys. The fusion environment was simulated by cyclotron implantation of helium followed by fission reactor irradiation. The effect of helium on a vanadium alloy, V-15Cr-5Ti, and the effect of helium in conjunction with neutron irradiation, has been studied by this method. Ductility, embrittlement and cleavage fractures were measured.

11847 **Effect of pulsed irradiation on microstructural evolution.** Packan, N.H. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **101**: No. 1-4, 189-198(1987). (CONF-8506165—).

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

Discontinuous irradiation, such as could ensue from the operation of a magnetic fusion reactor, may cause changes in the development of radiation damage microstructures. In this paper, the experimental observations of pulsing effects are collected and compared. Trends are related to the implications of theoretical mechanisms. The influence of pulsed irradiation is sensitive to such parameters as temperature, dose, pulse period, and duty factor. Aspects of the damage microstructure that have shown significant changes due to pulsing include dislocation loops, voids (especially at above-peak-swelling temperatures), and phase evolution under irradiation.

11848 **Irradiation effects on substructure related to irradiation softening.** Brimhall, J.L.; Simonen, E.P. (Pacific Northwest Lab., Richland, WA, USA). *Radiation Effects;* **101**: No. 1-4, vp(1987). (CONF-8506165—).

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

The evolution of the dislocation microstructure during irradiation of a deformed Fe-21/4Cr-1 Mo ferritic alloy was characterized by two competing processes. At low temperature, the dislocation density increased due to loop formation and interaction. At higher temperature, the dislocation density decreased due to recovery and polygonization of the original tangled cell structure. The transition temperature which separates these two processes decreased with increasing degree of cold work. Radiation-induced recovery of the deformation substructure was, however, only marginal compared to purely thermal-induced recovery. The observed transition in microstructure with temperature correlated well with the transition from hardening at low temperatures to softening at high temperatures observed during neutron irradiation. The dislocation evolution in cold-worked ferritic alloys is distinct from that observed in cold-worked austenitic alloys in that cold-worked or annealed starting conditions do not evolve to the same uniform dislocation density in the ferritic alloy as is observed in austenitic alloys.

11849 **Summary of discussion sessions.** Brimhall, J.L.; Trinkaus, H. (Pacific Northwest Lab., Richland, WA, USA; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung). *Radiation Effects;* **101**: No. 1-4, 301-303(1987). (CONF-8506165—).

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

The main points that emerged at the workshop on the investigation of irradiation effects under fusion conditions are summarized. There is no concensus as to what is definitely known about materials behaviour under these conditions and there is still incomplete data and sometimes conflicting results. Microstructural evolution, mechanical properties, swelling and simulation of fusion reactor conditions and its extrapolation to real conditions were discussed at the conference - all the papers are indexed separately. Recommendations for future research are briefly summarized.

11850 **Evaluation of core spray line cracks from Nine Mile Point Unit No. 1 and isolation condenser cracks at Oyster Creek Unit No. 1.** Czajkowski, C.J. (Brookhaven National Lab., Upton, NY, USA). *International Journal of Pressure Vessels and Piping;* **27**: No. 1, 1-15(1987). (CONF-850828—).

From 4. international seminar on assuring structural integrity of steel reactor pressure boundary components; Ispra, Varese, Italy (26 Aug 1985).

Two instances of stress corrosion cracking (SCC) of stainless steel were investigated at Brookhaven National Laboratory (BNL) in 1984. In May 1984, a periodic dye penetrant examination performed on the outside surface of a core spray line at Nine Mile Point Unit No. 1 disclosed several circumferentially oriented indications. The affected core spray line is 12 in (30.5 cm) nominal diameter, Schedule 80 austenitic stainless steel (Type 304). Evaluation of samples received at BNL disclosed that the cracking was transgranular with no indication of fatigue interaction. Evidence of chloride in addition to the observed transgranularity of the cracks led to the conclusion that the cracking resulted from a SCC mechanism induced by chloride contamination. On 22 March, 1984, The Oyster Creek Unit No. 1 facility developed a leak in the condensate piping near weld NE-2-12 of isolation condenser NE01-A, during hydrostatic testing of the system. Ultrasonic measurements were subsequently performed on the isolation condenser piping welds with the following results: 27 welds were affected, exhibiting approximately 50 ultrasonic testing (UT) indications. Three indications evaluated were entirely intergranular cracks initiating in the heat affected zone of the base metal. Some of these cracks progressed intergranu-

larly into the weld metal. A comparison of crack depths measured ultrasonically versus crack depths measured photomicroscopically showed a marked difference in some of the observed values.

11851 **Fracture toughness of two Ni-Fe-Cr alloys.** Mills, W.J. (Hanford Engineering Development Lab., Richland, WA, USA). *Engineering Fracture Mechanics;* 26: No. 2, 223-238(1987).

The Jsub(c) fracture toughness responses for unirradiated and irradiated Inconel 600 and Incoloy 800 were characterized at temperatures ranging from 24 to 538°C using the multiple-specimen Jsub(R)-curve technique. The fracture resistance for the unirradiated alloys was exceptionally high (Jsub(c) values ranging from 368 to 854 kJ/m^2 and tearing moduli ranging from 395 to 445), demonstrating that unstable fracture is not a primary concern for this class of materials. Neutron irradiation to 7-24 displacements per atom (dpa) caused an order of magnitude reduction in both Jsub(c) and tearing modulus. Electron fractographic examination revealed that this degradation in fracture resistance resulted from an irradiation-induced fracture-mechanism transition from microvoid coalescence to channel fracture.

11852 **In situ observations of partial dislocation climb in Ni_3Al.** Veyssiere, P.; Westmacott, K.H. (Lawrence Berkeley Lab., CA, USA). *Philosophical Magazine, A: Defects and Mechanical Properties;* 53: No. 4, 563-581(Apr 1986).

Changes in the configuration of screw and mixed dislocations in Ni_3Al have been monitored continuously during annealing in the hot stage of a high-voltage electron microscope. For experiments performed below (threshold voltage for displacement damage) initially straight dislocations in or close to screw orientation slowly increased their length and segmented into non-screw components during heating at 750°C. This is attributed to a resulting reduction in energy as the newly oriented segments climb dissociate into a more favourable plane where the APB energy is lower than the initial brace001brace glide dissociation plane. Above Vsub(upailon) radiation-produced interstitials induce asymmetrical climb of the 1/2<110> superpartial screw dislocations during irradiation at 650°C. One partial remains essentially unchanged as the other climbs into a helical configuration in a direction away from the position of the original screw dislocation. Energy balance considerations show that the single rather than double helix configuration will be favoured if the associated antiphase boundary energy is low. It is suggested that the low energy antiphase boundary is produced when helix turns are formed by the condensation of interstitial nickel atoms in an off-stoichiometric layer. The occasional observations of residual displacement fringe contrast supports this view.

11853 **Design of high-temperature, ordered intermetallic alloys.** Liu, C.T. (Oak Ridge National Lab., TN). *Oak Ridge National Laboratory Review;* 19: No. 3, 42-51(1986).

Basic and applied research on ordered intermetallic alloys at Oak Ridge National Laboratory is reviewed, with an emphasis on microstructural studies of high-temperature alloys based on Ni_3Al. Topics addressed include the general characteristics and potential applications of Ni_3Al, grain-boundary fracture and microalloying with B, stoichiometric effects, environmental effects, high-temperature ductility, hardening mechanisms, and mechanical behavior. Diagrams, graphs, photographs, and micrographs are provided.

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REFER ALSO TO CITATION(S) 11675, 11748, 11778, 11791, 12159, 13581, 13583

11854 **(AD-A—185140/1/XAB) Preparation of fine oxide powders by emulsion precipitation. Final report, 14 April 1985-14 April 1987.** Akinc, M. (Iowa State Univ. of Science and Technology, Ames (USA)). 31 May 1987. 62p. NTIS, PC A04/MF A01.

This program has centered on the preparation of fine ceramic oxide powders by a new method called emulsion precipitation. The main emphasis of the investigation was given to understanding the influence of emulsion characteristics on the morphology of the powders produced. It was found that the method proposed does, in fact, produce powders of submicron size and spherical shape for a relatively broad range of experimental conditions.

11855 **(CONF-870793—3) Structure and properties of nanophase TiO_2.** Siegel, R.W.; Hahn, H.; Ramasamy, S.; Zongquan, Li; Ting, Lu; Gronsky, R. (Argonne National Lab., IL (USA); Lawrence Berkeley Lab., CA (USA)). Jul 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002922/JAW.

From Conference on interface science and engineering; Lake Placid, NY, USA (12 Jul 1987).

Ultrafine-grained, nanophase samples of TiO_2 (rutile) were synthesized by the gas-condensation method and subsequent in-situ compaction, and then studied by transmission electron microscopy, Vickers hardness measurements, and positron annihilation spectroscopy as a function of sintering temperature. The nanophase compacts densified rapidly above 500°C, with only a small increase in grain size. The hardness values obtained by this method are comparable to or greater than coarser-grained compacts, but at temperatures 400 to 600°C lower than conventional sintering temperatures and without the need for sintering aids. 11 refs., 3 figs.

11856 **(CONF-870873—21) Normal and superconducting state properties of La/sub 2-x/Sr/sub x/CuO_4.** Kwok, W.K.; Crabtree, G.W.; Hinks, D.G.; Capone, D.W. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02. Order Number DE88003013/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

The resistivity, magnetoresistance, superconducting transition temperature, and critical fields for La/sub 2-x/Sr/sub x/CuO_4 were measured as a function of x. We find systematic behavior in the transition temperatures and critical field slopes, but not in the resistivities. 9 refs., 2 figs., 1 tab.

11857 **(CONF-870873—22) Spin disorder resistivity and bare Curie temperature in the ferromagnetic superconductor $ErRh_4B_4$.** Kwok, W.K.; Middleton, S.P.; Hall, L.N.; Dunlap, B.D.; Joss, W.; Crabtree, G.W.; Hinks, D.G. (Argonne National Lab., IL (USA); Purdue Univ., Lafayette, IN (USA). Dept. of Physics; Hughes Telecommunications, El Segundo, CA (USA); Institut Laue-Langevin, 38 - Grenoble (France); Boeing Aerospace Co., Seattle, WA (USA)). May 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02. Order Number DE88003016/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

Low temperature ac magnetoresistance measurements on a single crystal of $ErRh_4B_4$ were made to determine the bare Curie temperature and the spin disorder resistivity. A 'crossed field' technique was used to suppress the superconductivity in order to probe the normal state properties. The bare Curie temperature was found to be 1.07K and the spin disorder resistivity extrapolates to a finite value at T = OK. 6 refs., 2 figs.

11858 **(CONF-870873—24) Superconductivity in La/sub 1.85-x/Nd/sub x/Sr/sub .15/CuO_4.** Kwok, W.K.; Crabtree, G.W.; Umezawa, A.; Morss, L.; Soderholm, L. (Argonne National Lab., IL (USA)). May 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02. Order Number DE88003014/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

The effect of magnetic impurities on the high T/sub c/ superconductor La/sub 1.85/Sr/sub .15/CuO_4 was investigated by replacing La with Nd. We find a depression of T/sub c/ and dH/sub c2/dT with increasing Nd concentration which does not follow predictions of the pairbreaking effects due to magnetic impurities. We attribute our experimental results to a density of states effect. 8 refs., 2 figs.

11859 **(CONF-870881—5) High temperature superconductivity research at Argonne National Laboratory.** Fradin, F.Y. (Argonne National Lab., IL (USA)). 8 Jul 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003055/JAW.

From 18. conference on superconductivity in highly correlated fermion systems; Sendai, Japan (31 Aug 1987).

Results are presented on the YBa$_2$Cu$_3$O/sub 7-x/ phase, including the structure determination using neutron powder diffraction at IPNS, single-crystal measurements of magnetic anisotropy, and specific-heat measurements of the bulk superconducting transition. Theoretical and experimental considerations of the electronic anisotropies are discussed. 15 refs., 10 figs.

11860 **(CONF-870881—6) Electronic structure, charge transfer excitations and high temperature superconductivity.** Freeman, A.J.; Yu, Jaejun; Massidda, S.; Koelling, D.D. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy; Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003096/JAW.

From 18. conference on superconductivity in highly correlated fermion systems; Sendai, Japan (31 Aug 1987).

High precision local density electronic band structure results (for YBa$_2$Cu$_3$O$_7$, YBa$_2$Cu$_3$O$_8$ and GdBa$_2$Cu$_3$O$_7$) lead to the possibly important role of charge transfer excitations as the mechanism of high T/sub c/ superconductivity, and explain the coexistence of magnetism and superconductivity in the high T/sub c/ rare-earth superconductors. 21 refs., 3 figs.

11861 **(CONF-870881—8) Superconducting and magnetic properties of Fe-doped oxide superconductors.** Kimball, C.W.; Matykiewicz, J.L.; Giapintzakis, J.; Dwight, A.E.; Brodsky, M.B.; Slaski, M.; Dunlap, B.D.; Fradin, F.Y. (Northern Illinois Univ., Dekalb (USA); Northern Illinois Univ., Dekalb (USA). Dept. of Physics; Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003024/JAW.

From 18. conference on superconductivity in highly correlated fermion systems; Sendai, Japan (31 Aug 1987).

The superconducting and magnetic propertjes of the compounds La/sub 1.85/Sr/sub 0.15/Cu/sub 1-x/Fe/sub x/O$_4$ and YBa$_2$(Cu/sub 1-x/Fe/sub x/)$_3$ with $0 < x < 0.1$ are presented. The Fe substitution in the La-Sr compound rapidly depresses T/sub c/, extrapolating to T/sub c/ = 0 for $x \sim 0.02$. However, T/sub c/ is depressed much less rapidly in the Y-Ba compound, extrapolating to 0°K for $x \sim 0.12$. Moessbauer spectroscopy and magnetic data have been obtained to give information on the magnetic and structural properties of these materials. The results are compared with those for other dopants, both magnetic and nonmagnetic, in the oxide superconductors. 10 refs., 2 figs.

11862 **(CONF-8704231—2) NMR [nuclear magnetic resonance] imaging for detecting binder/plasticizers in green-state structural ceramics.** Ellingson, W.A.; Ackerman, J.L.; Gronemeyer, S.; Garrido, L. (Argonne National Lab., IL (USA); Massachusetts General Hospital, Boston (USA); Siemens Medical Systems, St. Louis, MO (USA)). Jun 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003111/JAW.

From 16. symposium on nondestructive evaluation; San Antonio, TX, USA (21 Apr 1987).

We have explored both a small-bore (<10 cm) experimental imaging system as well as a state-of-the-art medical imaging system relative to detection of the soft-solid (wax-like) binders used in ceramics. The ability to detect binders was evaluated on a 1.5-T medical MRI imager (Siemens Magnetom) using T_1-weighted imaging techniques and a 10-cm eye coil standard with the system. The ability to detect binders was also studied with a modified small-bore coil Technicare Facility using special rf and gradient coils. The initial results show that a medical system may not be able to detect binders unless elevated temperatures are used, whereas the experimental small-bore system shows the distribution quite well. In addition, higher magnetic field strength should be better for ceramics, since proton signal strength increases rapidly with the magnetic field strength. 11 refs., 9 figs., 3 tabs.

11863 **(CONF-8706237—1) Copper oxidation states, vacancy ordering and their effect on high temperature superconductivity.** Schuller, I.K.; Hinks, D.G.; Jorgensen, J.D.; Soderholm, L.; Beno, M.; Zhang, K.; Segre, C.U.; Bruynseraede, Y.; Locquet, J.P. (Argonne National Lab., IL (USA); Illinois Inst. of Tech., Chicago (USA). Dept. of Physics; Louvain Univ. (Belgium). Inst. voor Natuurkunde). Jul 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003079/JAW.

From NATO advanced study institute on physics, fabrication, and applications of multilayered structures; Ile de Bendor, France (22 Jun 1987).

We briefly review our comprehensive work on high temperature oxides which are isostructural with YBa$_2$Cu$_3$O/sub 7-δ/. X-ray and neutron diffraction, together with superconductive and normal state measurements show that the Cu-O chains present in the structure play an important role in the superconductivity. Whether the oxygen or the presence of copper in a 3^+ oxidation state is responsible for the high temperature superconductivity cannot be ascertained at the present time. 14 refs., 5 figs.

11864 **(LA-UR—87-3803) Radiation damage in YBa$_2$Cu$_3$O$_7$ by fast neutrons.** Willis, J.O.; Cost, J.R.; Brown, R.D.; Thompson, J.D.; Peterson, D.E. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 5p. (CONF-871124—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003157/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

The superconducting transition temperature of sintered YBa$_2$Cu$_3$O$_7$ decreases at a rate of 2.7 K/10^{18} n/cm^2 ($E > 0.1$ MeV) for fast neutron irradiation. The critical current density J/sub c/ increases a factor of three at zero field and more than three at nonzero fields for fluences up to 2 x 10^{18} n/cm^2. At both 7 and 75 K, J/sub c/ is decreasing with fluence near 3 x 10^{18} n/cm^2.

11865 **(LBL—24139) The structure and properties of twin boundaries in superconducting YBa$_2$Cu$_3$O$_7$.** Zandbergen, H.W.; Gronsky, R.; Chu, M.Y.; DeJonghe, L.C.; Holland, G.F.; Stacy, A. (Lawrence Berkeley Lab., CA (USA)). Nov 1987. Contract AC03-76SF00098. 11p. (CONF-871124—17). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003864/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

A relationship between preparation procedures, diamagnetic yield and twin densities in YBa$_2$Cu$_3$O$_7$ has been established. Decreasing the calcination temperature causes an increase in the formation of [100] 90° rotation twins and a corresponding change in the c/a ratio. At sufficiently high densities of these twins, the tetragonal structure is stabilized. Correlations between c/a ratio and twin densities with the critical temperature and diamagnetic yield are reported. 6 refs., 3 figs.

11866 **(MU/CERG—8311) Final report on evaluation of CANMET Nasicon ceramics in sodium/sodium cells.** Nicholson, P.S.; Munshi, M.Z.A. (McMaster Univ., Hamilton, Ontario (Canada). Ceramic Engineering Research Group). Nov 1983. 23p. (MICROLOG—84-1288). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Nine samples of Nasicon discs were forwarded to the Ceramic Engineering Research Group at McMaster University for testing in sodium-sodium cells. The surfaces of each disc were prepared by grinding to a parallel surface on a diamond wheel, grinding on a rotating wheel using a #600 grade wet emery paper (methanol being used), and mechanically polishing using diamond paste down to 1μm. The final mean thicknesses and diameters of the discs were recorded. X-ray diffraction was carried out on randomly selected discs and showed the materials to be crystalline. The a.c. impedance of each Nasicon disc was measured as a function of temperature. Once the electrical impedance had been measured, the electrolytes were characterised in sodium-sodium cells. The filling with sodium was carried out in an atmosphere of ultra-high purity argon to prevent aerial oxidation of the sodium. Experimental data

are presented to evaluate the degradation of each electrolyte. 13 figs.

11867 (MU/MMS—8406) Study of synthesis of NGS, NYS, and beta-alumina. Nicholson, P.S. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Metallurgy and Materials Science). Jun 1984. 17p. (MICROLOG—85-0554). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The samples were mixed, cooled in an ice water bath for 2-3 hours prior to mixing and spraying. The solution was spray-dried and stirred constantly to maintain the precipitates in suspension. The NGS and NYS were calcined at 540/sup 0/C for 24 hours and 620/sup 0/C for 3.5 hours respectively. The temperature was increased slowly and the yield following calcination was 70-72%. The powder was ball-milled overnight using teflon grinding media. These conditions are requisite to produce single-phase sintered NGS and NYS. During sintering, all samples were covered by an atmosphere of their own powder. Density measurements were conducted on all samples using the liquid immersion technique. X-ray diffraction analysis was used to determine the phase composition of the sinter. The results are tabulated in this report. 8 tabs.

11868 (N—88-10120) Pressure effects on the thermal stability of SiC fibers. Jaskowiak, M.H.; Dicarlo, J.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 16p. (NASA-TM—100146; E—3704; NAS—1.15:100146; CONF-860418—). NTIS, PC A03/MF A01.

From 88. annual meeting of the American Ceramic Society; Chicago, IL, USA (27 Apr 1986).

Commercially available polymer derived SiC fibers were treated at temperatures from 1000 to 2200 C in vacuum and argon gas pressure of 1 and 1360 atm. Effects of gas pressure on the thermal stability of the fibers were determined through property comparison between the pressure treated fibers and vacuum treated fibers. Investigation of the thermal stability included studies of the fiber microstructure, weight loss, grain growth, and tensile strength. The 1360 atm argon gas treatment was found to shift the onset of fiber weight loss from 1200 to above 1500 C. Grain growth and tensile strength degradation were correlated with weight loss and were thus also inhibited by high pressure treatments. Additional heat treatment in 1 atm argon of the fibers initially treated at 1360 atm argon caused further weight loss and tensile strength degradation, thus indicating that high pressure inert gas conditions would be effective only in delaying fiber strength degradation. However, if the high gas pressure could be maintained throughout composite fabrication, then the composites could be processed at higher temperatures.

11869 (ORF—830406) Chemical vapour deposited coatings for high temperature corrosion resistance. Final report. Shimizu, H.; Gibbon, W.M. (Ontario Research Foundation, Sheridan Park (Canada)). 6 Apr 1983. 21p. (MICROLOG—87-03985). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The application of anti-corrosion, abrasion-resistant coatings on low cost substrate materials such as mild steel offers an attractive alternative to the use of expensive alloys which are required for some components of fossil energy conversion systems. Chemical vapour depostion (CVD) is a means of producing a number of refractory coatings, such as titanium diboride, which may provide the necessary protection from the hostile environments generated by fossil energy conversion. The experimental conditions required to form titanium diboride coatings on coupons of carbon steel sheet were investigated in Phase 1 of this project. In Phase 2 cylindrically-shaped specimens of steel were coated with TiB/sub 2/. Sublayers of electrodeposited nickel and titanium carbide as well as controlled slow cooling were required to prevent flaking of the coating. Tests being conducted on these specimens indicate that TiB/sub 2/ coatings applied by CVD provide good protection against corrosion by sulphurous gases at 800/sup 0/C. 8 figs., 3 tabs.

11870 (ORF/GC—67060) Development of abrasion resistant glass-ceramics from industrial waste products. Final report. von Roode, M. (Ontario Research Foundation, Mississauga (Canada). Dept. of Glass and Ceramics). 26 May 1983. 66p. (MICROLOG—84-1279). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Slag-ceramics were produced from glass compositions using pelletized slag as the major ingredient. The abrasion resistance, fracture toughness and microstructure of the prepared glass and glass-ceramics were evaluated. Glas-ceramics with good abrasion resistance were obtained when iron oxide in conjunction with carbon was used as a nucleating agent. 5 figs., 11 tabs.

11871 (PB—88-102587/XAB) Critical spin dynamics of EuO. A coupled-mode study. Carra, P.; Lovesey, S.W. (Rutherford Appleton Lab., Chilton (UK)). Jun 1987. 19p. (RAL—87-034). NTIS, PC E03/MF E03.

See also PB—86-172863.

The objective of this paper is a thorough discussion of coupled-mode-theory results for a Heisenberg ferromagnet and a comparison of them with the renormalization-group predictions. The sections are arranged as follows. Section 3 contains a brief discussion of the magnetic Hamiltonian and of the relevant experimental quantities. The case of EuO is explicitly considered and equilibrium properties of interest described. The main results of the coupled-mode theory are reviewed in Section 4. In Section 5 the procedure, by which the coupled-mode equation is solved, is discussed; contact is made with the renormalization-group formulation as far as dynamic scaling properties are concerned; and, finally, a summary of the results obtained is presented and discussed.

11872 (RAL—87-062) Determination of the magnetic penetration depth of the high Tsub(c) superconductor YBa/sub 2/Cu/sub 3/Osub(7-x). Felici, R.; Penfold, J.; Ward, R.C.; Olsi, E.; Matacotta, C. (Rutherford Appleton Lab., Chilton, UK; ITM-CNR, Cinisello Balsamo, IT). (Rutherford Appleton Lab., Chilton (UK)). Sep 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751647/JAW.

The authors report the measurement of the magnetic penetration depth of the high Tsub(c) superconductor YBa/sub 2/ Cu/sub 3/ Osub(7-x) by polarized neutron reflection. A value of 225 + - 75 A (which represents an upper limit) was obtained at 4.8 K and in an applied magnetic field of 350 oersteds. The value is small compared to other recently reported values for conventional superconductors.

11873 (RAL—87-065) Correlation mediated superconductivity in a 'High-Tsub(c)' model. Long, M.W. (Rutherford Appleton Lab., Chilton (UK)). Aug 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751650/JAW.

A simple model is presented to account for the High-Tsub(c) perovskite superconductors. The superconducting mechanism is purely electronic and comes from local Hubbard correlations. The model comprises a Hubbard model for the copper sites with a single particle oxygen band between the two copper Hubbard bands. The electrons move only between nearest neighbour atoms which are of different types. Using two very different approximation schemes, one related to 'Slave-Boson' mean field theory and the other based on an exact local Fermion transformation, the possibility of copper-oxygen or a mixture of copper-oxygen and oxygen-oxygen pairing is shown. The author believes that the most promising situation for superconductivity is with the Oxygen band over half-filled and closer in energy to the lower Hubbard band.

11874 (SAND—87-2579C) High temperature processing of superconducting $Y_1Ba_2Cu_3O/sub\ 6.9/$. Ginley, D.S.; Venturini, E.L.; Kwak, J.F.; Baughman, R.J.; Morosin, B. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 11p. (CONF-8710216—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003002/JAW.

From Symposium on high-temperature materials chemistry; Honolulu, HI, USA (18 Oct 1987).

The YBaCuO system has produced superconductors with T/sub c/ over 90K. Integral to the production of these materials are high temperature sintering and subsequent oxygen annealing processes. Results are presented directed toward optimizing these two process steps. Oxygen stabilized the YBa_2Cu_3O/sub 6.9/ material against decomposition to temperatures near the melting point, allowing processing at higher temperatures, which produced significantly higher quality single phase material and somewhat improved grain to grain contacts. 16 refs., 4 figs., 1 tab.

11875 (SAND—87-2750C) Freestanding films of YBa_2Cu_3O/sub 6.9/. Ginley, D.S.; Mitchell, M.A.; Fu, W.; Kwak, J.F.; Venturini, E.L.; Baughman, R.J. (Sandia National Labs., Albuquerque, NM (USA); Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). 1987. Contract AC04-76DP00789. 4p. (CONF-871124—22). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003995/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Thick (20 to 300 μm) freestanding films of ceramic YBa_2Cu_3O/sub 6.9/ have been obtained by resintering YBa_2Cu_3O/sub 6.9/ powder in air after screen printing onto fused silica substrates. An interfacial reaction occurs between the powder and the silica substrate which efficiently debonds the resintered film upon cooling. The magnetization and transport properties of these films are comparable to those for high quality bulk ceramic samples. 5 refs., 2 figs.

11876 Superconducting and structural properties of sputtered thin films of YBa_2Cu_3O/sub 7-//sub x/. Makous, J.L.; Maritato, L.; Falco, C.M.; Cronin, J.P.; Rajendran, G.P.; Uhlmann, E.V.; Uhlmann, D.R. (Department of Physics, Optical Sciences Center, Arizona Research Laboratories, University of Arizona, Tucson, Arizona 85721). *Applied Physics Letters;* **51**: No. 25, 2164-2166(21 Dec 1987).

We have fabricated thin films of YBa_2Cu_3O/sub x/ by dc triode sputtering from two metallic targets. Post-annealing in pure O_2 after sputtering resulted in superconducting films with a T/sub c/ onset as high as 89 K and a midpoint T/sub c/ of 75 K. We report preliminary results of films deposited on sapphire, MgO and sol-gel coatings of ZrO_2 on sapphire, with and without buffer layers of Ag. The chemical and physical structures of these films were analyzed by using several x-ray diffraction techniques and Rutherford backscattering spectroscopy.

11877 Neutron-scattering studies of phonons in disordered cubic zirconia at elevated temperatures. Liu, D.W.; Perry, C.H.; Feinberg, A.A.; Currat, R. (Department of Physics, Northeastern University, Boston, Massachusetts 02115). *Physical Review [Section] B: Condensed Matter;* **36**: No. 17, 9212-9218(15 Dec 1987).

Inelastic-neutron-scattering studies of cubic zirconia at elevated temperatures (300—1700 K) showed well-defined LA and TA phonons but no optical-phonon branches were observed, confirming earlier reported reduced Raman scattering data. The LA and TA phonons were observed to broaden with a q^3 dependence. The elastic constants C/sub 11/, C/sub 12/, and C/sub 44/ were derived from the dispersion data at room temperature and at elevated temperatures. The frequency distribution of one phonon density of states was generated from the dispersion relation and was found to be in reasonable agreement with the observed Raman spectrum. Also diffuse-elastic-scattering measurements were taken and showed broad intensity peaks in reciprocal space. The scattering and the phonon linewidths showed little temperature dependence; intrinsic defects and anharmonicity dominate the damping mechanism. The unobserved optical branches were obtained by the best fit to the experimentally determined acoustic branches, based upon a rigid-ion-model calculation. Static deformations of the oxygen sublattice due to oxygen vacancies are mainly responsible for the data observed.

11878 Ordering and decomposition in the high-temperature superconducting compound YBa_2Cu_3O/sub x/. Khachaturyan, A.G.; Morris J.W. Jr. (Center for Advanced Materials, Lawrence Berkeley Laboratory and Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720). *Physical Review Letters;* **59**: No. 24, 2776-2779(14 Dec 1987). Contract AC03-76SF00098.

The method of concentration waves is applied to structural transformations in superconducting Y-Ba-Cu oxide. The method predicts an ordering reaction that results in a tetragonal-to-orthorhombic phase transformation, and also yields the correct structure of the $YBa_2Cu_3O_7$ orthorhombic ordered phase. The results suggest that at low temperature the off-stoichiometric orthorhombic phase is thermodynamically unstable with respect to secondary decomposition into a mixture of ordered orthorhombic and disordered tetragonal phases, whose microstructure can be anticipated.

11879 Anomalous high-temperature hopping in metal hydrides. Richards, P.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5800). *Physical Review [Section] B: Condensed Matter;* **36**: No. 14, 7417-7421(15 Nov 1987). Contract AC04-76DP00789.

Recent NMR T_1 data on metal hydrides and earlier data on PbF_2 indicate the jump rate of hopping protons or fluorine ions decreases with increasing temperature at high temperature. This behavior is attributed to strong repulsions at the saddle point which increase with temperature as vibrational amplitudes increase. It consequently becomes harder to move through the saddle point at elevated temperature. Model potentials are used to obtain agreement with the data.

11880 X-ray-absorption spectroscopy studies of glassy As_2S_3: The role of rapid quenching. Yang, C.Y.; Sayers, D.E.; Paesler, M.A. (Department of Physics, North Carolina State University, P.O. Box 8202, Raleigh, North Carolina 27695-8202). *Physical Review [Section] B: Condensed Matter;* **36**: No. 15, 8122-8128(15 Nov 1987).

We have examined the effect of the thermal quenching rate on the structure of As_2S_3 chalcogenide glasses. Structural differences among glasses are discussed on the basis of results of x-ray-absorption measurements. We find that small structural differences are seen among glassy As_2S_3 samples bulk quenched from various temperatures between 350 and 800 °C. Comparatively large changes are observed, however, among samples quenched from annealing temperatures between 200 and 300 °C with the structural disorder decreasing with increasing annealing temperature. Material quenched at 300 °C shows a strong tendency toward ordering. Structural differences among samples are discussed in terms of (1) distortions in the As: S: As bond angles between helices and within a helix and (2) deviations of the As apex angles.

11881 Steel bonded dense silicon nitride compositions and method for their fabrication. Landingham, R.L.; Shell, T.E. (to Dept. of Energy, Washington, DC). US Patent 4,703,884. 3 Nov 1987. Filed date 20 Nov 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method of fabricating a multilayered ceramic-metal composite is described comprising: (a) polishing a surface of a dense ceramic material to enhance wetting and reaction with molten reactive material; (b) applying a thin slurry coating of a fine powder mixture of a refractory material comprising a mixture of powdered nickel and molybdenum silicide and bonding it to the surface of the ceramic material; (c) grinding the layer of refractory material to uniform thickness; (d) brazing a surface of the layer of refractory material with a metal alloy at elevated temperatures; and (e) pressure bonding a metal piece to the metal alloy to form the composite.

11882 Steel bonded dense silicon nitride compositions and method for their fabrication. Landingham, R.L.; Shell, T.E. (to Dept. of Energy, Washington, DC). US Patent 4,704,338. 3 Nov 1987. Filed date 20 Nov 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A multilayered composite is described comprising: a layer of high density, sintered silicon nitride; a layer of refractory material comprising a mixture of powdered nickel and molybdenum silicide; a layer of a brazing alloy; and a layer of metal, with the layer of brazing alloy sandwiched between the layer of metal and the layer of refractory material. This patent describes a silicon nitride rotor and steel shaft for a turbine or air compressor or diesel engine bonded together by the method comprising: (a) polishing a surface of a dense, sintered silicon nitride rotor to enhance wetting of the surface; (b) slurry coating and bonding to the surface of the silicon nitride rotor, a layer of a refractory material comprising a mixture of powdered nickel and molybdenum silicide; (c) grinding the layer of the refractory material to uniform thickness; (d) brazing the layer of the refractory material with a nickel-copper-silver or nickel-copper-manganese alloy at elevated temperatures; and (e) pressure bonding a steel shaft to the refractory material and the alloy.

11883 **Antiferromagnetic order in $DyBa_2Cu_3O_7$.** Goldman, A.I.; Yang, B.X.; Tranquada, J.; Crow, J.E.; Jee, C. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **36**: No. 13, 7234-7236(1 Nov 1987).

Neutron diffraction measurements on the high-temperature superconductor $DyBa_2Cu_3O_7$ have revealed antiferromagnetic ordering of the Dy moments below 1 K. The magnetic unit cell is obtained from doubling the orthorhombic chemical unit cell along all three basis vectors; q/sub magnetic/ = ((1/2, 1) / 2 ,(1/2). Within experimental error, the moments are aligned along the c axis of the structure and the ordered moment is 7.2 +- 0.6μ/sub B/, which is smaller than the full moment of 10μ/sub B/.

11884 **Enhanced critical magnetization currents due to fast neutron irradiation in single-crystal YBa_2Cu_3O/sub 7-// sub δ/.** Umezawa, A.; Crabtree, G.W.; Liu, J.Z.; Weber, H.W.; Kwok, W.K.; Nunez, L.H.; Moran, T.J.; Sowers, C.H.; Claus, H. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **36**: No. 13, 7151-7154(1 Nov 1987).

Magnetization measurements were performed on single crystals of YBa_2Cu_3O/sub 7-//sub δ/ to study the effect of fast neutron irradiation on flux pinning and the critical magnetization current. Neutron irradiation up to a fluence of 8.16 x 10/sup 17/ n/cm^2 systematically enhanced the magnitude and reduced the anisotropy of the critical magnetization current compared to unirradiated samples. The largest increases in the critical magnetization current occurred at 77 K. There was a slight linear decrease in the transition temperature with neutron fluence.

11885 **Oxygen content of superconducting perovskites, La/sub 2-x/Sr/sub x/CuO/sub y/ and YBa_2Cu_3O/sub y/.** Appelman, E.H.; Morss, L.R.; Kini, A.M.; Geiser, U.; Umezawa, A.; Crabtree, G.W.; Carlson, K.D. (Argonne National Lab., IL). *Inorganic Chemistry;* **26**: No. 20, 3237-3239(7 Oct 1987). Contract W-31-109-ENG-38.

Studies of the composition of YBa_2Cu_3O/sub y/ in which the oxidation states of Y and Ba are +3 and +2, respectively, have shown a direct relationship between the Cu(II)/Cu(III) ratio and the oxygen stoichiometry. Idometry or hydrogen reduction has generally been used for the Cu(III) determination. A modification of the idometric method that is simple to apply and is particularly suited to analyses of La/sub 2-x/Sr/sub x/CuO/sub y/ and YBa_2Cu_3O/sub y/ is described. The results of application to determination of the oxygen content of YBa_2Cu_3O/sub y/ are presented, and the oxygen content is related to the crystallographic and superconducting properties of the material. Results indicated that at room-temperature large variations of the oxygen content of the orthorhombic phase of YBa_2Cu_3O/sub y/ could occur without change in the lattice parameters or appreciable impairment of the resistive superconducting transition or diamagnetic properties. 13 references, 1 figure, 1 table.

11886 **Topochemical reduction of the high temperature superconductor YBa/sub 2/Cu/sub 3/O/sub 7/: the structure of YBa/sub 2/Cu/sub 3/O/sub 6/ by neutron diffraction.** Toroardi, C.C.; McCarron, E.M.; Bierstedt, P.E.; Sleight, A.W.; Cox, D.E. (Du Pont de Nemours, E.I. and Co., Wilmington, DE, USA; Brookhaven National Lab., Upton, NY, USA). *Solid State Communications;* **64**: No. 4, 497-500(Oct 1987).

Superconducting orthorhombic YBa/sub 2/Cu/sub 3/Osub(6.8) has been reduced to tetragonal YBa/sub 2/Cu/sub 3/O/sub 6/ without structural collapse by heating under a nitrogen atmosphere at 900/sup 0/C. Further reduction above approx. 950/sup 0/C results in destruction of the perovskite-related structure. Neutron powder diffraction data were fitted by the Rietveld profile refinement method to obtain the structure of YBa/sub 2/Cu/sub 3/O/sub 6/. The reduced material is viewed as containing isolated linear Cu/sup 1+/O/sub 2/ units and square pyramidal Cu/sup 2+/O/sub 5/ units that share oxygen atoms to form a two-dimensional copper-oxygen network. Semiconducting behavior is observed for YBa/sub 2/Cu/sub 3/O/sub 6/ from 4.2 K to 300 K consistent with such a localized-electron model. The structural refinement of YBa/sub 2/Cu/sub 3/O/sub 6/ shows that the linear (Cu-O)sub(n) chains present in YBa/sub 2/Cu/sub 3/O/sub 7/ are now completely absent.

11887 **Does magnetism hold the key.** Emery, V.J. (Brookhaven National Lab., Upton, NY, USA). *Nature (London);* **328**: No. 6133, 756-757(27 Aug 1987).

The paper concerns the microscopic nature of the superconducting state, and the source of the electronic interaction that gives rise to it. Exchange processes are discussed with respect to the coulombic repulsion between electrons, BCS theory, and phonon exchange. The isotope effect is also examined, including s-state pairing and the antiferromagnetic correlations between spins.

11888 **Dynamic and static fatigue behavior of sintered silicon nitrides.** Chang, J.; Khandelwal, P.; Heitman, P.W. *Ceramic Engineering and Science Proceedings;* **8**: 766-777(Aug 1987). (CONF-870172—).

From 11. annual conference on composites; Cocoa Beach, FL, USA (18 Jan 1987).

The dynamic and static fatigue behavior of Kyocera SN220M sintered silicon nitride at 1000 C was studied. Fractographic analysis of the material failing in dynamic fatigue revealed the presence of slow crack growth (SCG) at stressing rates below 41 MPa/min. Under conditions of static fatigue this material also displayed SCG at stresses below 345 MPa. SCG appears to be controlled by microcracking of the grain boundaries. The crack velocity exponent (n) determined from both dynamic and static fatigue tests ranged from 11 to 16. 10 references.

11889 **Microstructure of mullite/ZrO/sub 2/ and mullite/Al/sub 2/O/sub 3//ZrO/sub 2/ tough ceramic composites.** Rincon, J.M.; Dinger, T.R.; Thomas, G.; Moya, J.S.; Osendi, M.I. (Instituto de Ceramica y Vidrio Arganda del Rey (Madrid)). *Acta Metallurgica;* **35**: No. 5, 1175-1180(May 1987).

The microstructural evolution in mullite/zirconia and mullite/alumina/zirconia composites after different duration heat treatments at 1570°C has been investigated by scanning electron microscopy (SEM), transmission electron microscopy (TEM) and energy dispersive X-ray microanalysis. The effect of free alumina on microstructural and mechanical parameters is also reported.

3606 Other Materials

REFER ALSO TO CITATION(S) 10712, 10812, 10873, 11036, 11162, 11162, 11199, 11200, 11201, 11214, 11495, 11708, 11836, 11983, 11989, 12156, 12156, 12598, 12630, 13581

11890 **(AD-A—184826/6/XAB) Cryogenic failure mechanisms of fiber-epoxy composites for energy applications.** Jang, B.Z.; Lieu, Y.K.; Chang, Y.S.; Hwang, L.R. (Auburn Univ., AL (USA). Dept. of Mechanical Engineering). Jun 1987. 12p. NTIS, PC A03/MF A01.

Pub. in Polymer Composites, Vol. 8, No. 3, 188-198(Jun 1987).

Fiber-reinforced composites used in the production, storage, and transport of energy are often exposed to extreme environments such as cryogenic temperatures and/or nuclear radiation. The fracture resistance of composites subjected to these conditions are of fundamental interest. A study was undertaken to examine the effects of gamma radiation on the structure and properties of fibers, matrix and their interfacial bonding in terms of their influence on composite failure mechanisms. Also, thermomechanical analysis was conducted to estimate the residual thermal stresses due to differential thermal expansion coefficients both between fiber and matrix and between two laminae. Results indicate that the impact energy of a composite laminate could be increased by 100% by immersing the specimen in liquid nitrogen for only five min. Samples impact-tested at cryogenic temperatures were found to possess a great degree of delamination and crack bifurcation.

11891 **(AD-A—184828/2/XAB) Plasma joining of metal-matrix composites. Interim technical report, October 1986-January 1987.** Raynolds, G.H.; Yang, L. (MSNW, Inc., San Marcos, CA (USA)). Jun 1987. 12p. NTIS, PC A03/MF A01.

Microstructural and microchemical changes occurring in the heat-affected zone, at the fusion line, and in the weld metal of low-pressure, transferred arc-plasma-process welds produced with composite powder-filler metals are described.

11892 **(AD-A—185086/6/XAB) Quasi-periodic semiconductor superlattices.** Merlin, R.; Bajema, K.; Clarke, R.; Todd, J. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). 1987. 5p. NTIS, PC A02/MF A01.

A brief overview of the unique structural, electronic, and vibrational properties of quasi-periodic (Fibonaccii) superlattices is presented, together with results of x-ray, Raman scattering, and optical absorption experiments on the GaAs-Al(x)Ga(1-x)As system.

11893 **(AD-A—185093/2/XAB) Radiation sensitivity of select metal-chelate polymers: mechanistic changes at higher energies. Technical report.** Archer, R.D. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemistry). 1 Apr 1987. 6p. (TR—9). NTIS, PC A02/MF A01.

11894 **(AD-A—185200/3/XAB) Micromechanisms of fatigue crack growth and fracture toughness in metal-matrix composites. Technical report, 29 April 1986-31 July 1987.** Davidson, D.L. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1987. 29p. NTIS, PC A03/MF A01.

Fatigue crack growth and fracture toughness of seven combinations of aluminum-matrix alloys reinforced with particulate silicon carbide were measured. The matrix alloys used were of both the work-hardening and heat-treatable varieties. Two of the alloys were made by mechanical alloying - powder-metallurgy fabrication methods and the remainder were made by ingot metallurgy. Composites were tested in both as-received (extruded) and packaged conditions. Fractography was done for all the composites, as were cross sections to examine surface roughness.

11895 **(CEA-CONF—9123) Antiferromagnetic anisotropy in organic superconductors: a probe for the spin density wave (SDW) amplitude and nesting vector.** Roger, M.; Delrieu, J.M.; Wope Mbougue, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). Aug 1987. 3p. (CONF-870873—25). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751710/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

The qualitative differences experimentally observed for the anisotropy axes in the SDW states of (TMTTF)/sub 2/X and (TMTSF)/sub 2/X salts are interpreted with pure dipolar anisotropy in sulfur compounds and competing spin orbit and dipolar anisotropy in selenium compounds. The anisotropy energies and axes are calculated as a function of the SDW amplitude δ and wave vector Q. The comparison with AFR data provides new estimates of Q and δ. The results are compared with those deduced from NMR on methyl protons.

11896 **(CO—791204) An assessment of the commercial feasibility of the CANMET developed Rapid Investment Shell process.** (Canadian Oxygen Ltd., Mississauga, Ontario). 4 Dec 1979. 3p. (MICROLOG—86-01204). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A number of tests have been carried out to assess the technical feasibility of the Rapid Investment Shell process developed by the Department of Energy, Mines and Resources. These tests have met with mixed success. Trials thus far have revealed some major problems in reproduction of the Rapid Shell Process. The first is that the time savings ascribed to this process are lost through a combination of factors. To prevent slumping, a longer draining time after each dip is required. The drying time for a mould is greater than 17 hours. Wax patterns must be modified to allow the removal of the dipping handle from the wet mould, resulting in added time and material expense in the wax room. The need to repeatedly stop and start the slurry tank mixers while dipping contributes to the time element, creates an additional step in the dipping routine, and introduces a wear factor for the machinery. The slumping problem always seems to be present in varying degrees. This problem will be accentuated with increasing part size. The fragility of the wet mould may also worsen in larger parts.

11897 **(CONF-8705173—2) Importance of intermolecular hydrogen...hydrogen and hydrogen...anion contacts for the lattice softness and the superconductivity of β-(ET)$_2$X (X$^-$ = I$_3^-$, AuI$_2^-$, IBr$_2^-$).** Whangbo, Myung-Hwan; Williams, J.M.; Schultz, A.J.; Beno, M.A. (North Carolina State Univ., Raleigh (USA). Dept. of Chemistry; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003120/JAW.

From NATO ASI meeting on organic and inorganic low dimensional crystalline materials; Minorca-Beleares, Spain (3 May 1987).

The dependence of the T/sub c/ of β-(ET)$_2$X upon the anion X$^-$ and applied pressure P is explained in terms of how the softness, and hence the electron-phonon coupling constant λ, of the β-(ET)$_2$X lattice varies as a function of X$^-$ and P. What really governs the lattice softness is the short hydrogen...anion and hydrogen...hydrogen contacts, which occur as a consequence of the attractive Coulombic interactions between layers of Et/sup 0.5+/ donors and those of X$^-$ anions. In agreement with our analysis, the recent point-contact measurement on β-(ET)$_2$X indicates the presence of a very soft phonon strongly coupled to the electrons. 7 refs., 11 figs., 1 tab.

11898 **(CONF-8706187—, pp 37-44) Properties of elastomeric laminates.** Clark, S.K.; Dodge, R.N. (Univ. of Michigan, Ann Arbor). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Significant energy loss occurs in reinforced elastomers due to internal hysteresis, and most such materials exhibit strong nonlinearities both in their real and imaginary response to cyclic loads. Application of FEM techniques to design for minimization of hysteretic loss requires realistic material models which represent laminate response in the low strain region, where most applications reside. The objective of this study was to propose a bilinear material property description suitable for most cord-rubber laminates, and to present typical data for commonly used reinforcing materials.

11899 **(CONF-8706187—, pp 45-51) New experiments on the Langmuir film balance.** Morrison, G.; Pegg, I.L. (National Bureau of Standards, Gaithersburg, MD). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

The design and construction of a wide-range, automated film balance and a set of experiments on a well-documented material to test the instrument during its development are described. The balance can be operated in the temperature range 5-50°C. It can meas-

ure surface tension differences up to 50 mN m^{-1} with an imprecision of +/- 0.01 mN m^{-1}. The measurements of the liquid-expanded (LE)-liquid-compressed (LC) and the liquid-vapor transitions in pentadecanoic acid monolayers on water to confirm recent suggestions that long-standing ideas about these two transitions might be in error and that a thorough reexamination of many classic measurements will be necessary.

11900 **(CONF-8708173—2) Recent progress in BEDT-TTF [bis(ethylenedithio)-tetratiofulvalene] based synthetic metals.** Wang, H.H.; Allen, T.J.; Schlueter, J.A.; Hallenbeck, S.L.; Stupka, D.L.; Chen, M.Y.; Despotes, A.M.; Kao, H-C.I.; Carlson, K.D.; Geiser, U. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002947/JAW.

From 5. international symposium on the chemistry of selenium and tellurium; Oak Ridge, TN, USA (24 Aug 1987).

BEDT-TTF based organic metals with tetrahedral and linear anions are reviewed. New $(ET)_2MX_4$ complexes, their electrical and ESR properties are reported (M = Ga, In, Tl, and X is halides). A novel solid state phase transformation from semiconducting α to superconducting β-$(ET)_2IBr_2$ is presented. 40 refs., 5 figs., 2 tabs.

11901 **(CONF-8709116—6) Models for ionic transport in glass.** Mundy, J.N. (Argonne National Lab., IL (USA); Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.)). 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002860/JAW.

From 6. international conference on solid state ionics; Garmisch-Partenkirchen, F.R. Germany (6 Sep 1987).

A satisfactory model for ionic transport in glass proves elusive. The apparent success of the weak electrolyte theory in interpreting a number of the electrical properties is shown to be illusory as the same evidence provides an equally satisfactory justification for regarding glasses as highly defected solids. Evidence other than ionic transport measurements is introduced to show that there are more alkali ion sites than alkali ions in a glass. The overall weight of evidence suggests it is appropriate to interpret ionic transport in glass on the basis of a high defect concentration model. 47 refs.

11902 **(DOE/ER/45273—1) Monitoring interfacial dynamics by pulsed laser techniques: Annual report.** Richmond, G. (Oregon Univ., Eugene (USA)). 1987. Contract FG06-86ER45273. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003362/JAW.

Several types of materials have been surveyed including thin film and layered semiconductors as well as a metal and semimetal. Second harmonic (SH) generation measurements on these materials were made using both nanosecond (Q-switched) and picosecond (mode-locked) pulsed Nd:YAG lasers with appropriate gated or photon counting detection. Initial studies were performed under steady state conditions in order to optimize the experiments for time-resolved studies. SHG were also extended to the time domain. A means of monitoring surface structure and reconstruction phenomena in-situ was developed. This discovery now opens a broad new area of dynamic interfacial measurements to be done in-situ.

11903 **(ENEA-RT-TIB—86-40) Effects of thermal ageing and gamma radiations on ethylene-propylene based insulator of electric cables.** Baccaro, S.; D'Atanasio, P. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1986. 87p. (In Italian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701282/JAW.

This paper describes the effects of gamma radiation and thermal aging on cable insulator. The elastic properties degrade rapidly as the absorbed dose increases: the percent elongation at break attains nearly 100% value at 0.5 MGy absorbed dose. The gases evolved during the irradiation are mainly H/sub 2/ and CO/sub 2/; CO, CH/sub 4/ and C/sub 2/ H/sub 6/ are present in much lower concentrations. The damage undergone depends strongly on sequential radiation and thermal aging; the analysis of accelerated life test data by means of the Arrhenius model gave (1.23+-0.25) eV for the activation energy, about 1 eV higher than the values reported in the literature.

11904 **(ETSU-WN—5065-P1) Report on an investigation into the variability of the elastic modulus of concrete. Final report.** Davidson, R.J. (UKAEA Atomic Energy Research Establishment, Harwell. Energy Technology Div.). Mar 1987. 110p. (TWC—014H/87/3241). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The design of concrete support towers for wind turbine structures requires an accurate knowledge of the elastic modulus of concrete and its variation with time, in order that they can be designed with a pre-determined natural frequency. A detailed study of published literature was used to produce an extensive data-base on the modulus of elasticity of concrete, from which a new eight step prediction method was developed. This method allows an assessment of the elastic modulus to within 9% at any particular time. It is based on knowledge of the coarse aggregate properties used in the concrete mix and the corresponding mean 28 day concrete cube strength. Further factors are applied for environmental, age and loading conditions.

11905 **(EUR—10331) Synthesis and development of separators for alkaline electrolysers.** Giuffre, G. (Commission of the European Communities, Luxembourg). 1985. 219p. (In Italian). NTIS (US Sales Only), PC A10. Order Number DE88751487/JAW.

In this report are examined separators based on asbestos reinforced with polyphenylene sulfide or sulfonated polyphenylene sulfide for alkaline water electrolysis at 120/sup 0/C. Polymerization and copolymerization of monomers are studied. Resistance to boiling KOH, mechanical and physicochemical properties are studied. Addition of Mg (OH/sub 2/ to improve properties and decrease voltage drop is also examined.

11906 **(IA—1428) Growth of Pb/sub 1-x/Eu/sub x/Te epitaxial layers by the liquid phase epitaxy technique.** Hacham, A. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Jun 1987. 68p. (In Hebrew). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701022/JAW.

Contains an annotated bibliography of 40 references.

Lead salts are direct narrow-gap semiconductors useful for optoelectric devices - mainly, injection diode lasers. Pb/sub 1-x/Eu/sub x/Te is a new compound in this family. The incorporation of Eu into PbTe lattice causes a rapid increase of the energy gap, enabling the fabrication of devices operating at wavelengths shorter than 5μm in the infrared region. Diode lasers of this compound operate at higher temperatures than usually achieved. In this work, for the first time, we report the growth of (Pb,Eu)Te from solutions using Liquid Phase Epitaxy (LPE) technique.

11907 **(JINR-R—17-85-809) Polyacetylene and two-dimensional models of quantum field theory. Lectures for young scientists.** Osipov, V.A.; Fedyanin, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1985. 81p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701189/JAW.

Theoretical models used for description of properties of polyacetylene are discussed. Analogy between two-dimensional models of quantum field theory and polyacetylene model is drawn. Some consequences of this analogy are considered. The problem of a charge localized on a soliton is discussed. The mechanism of fractional charges and some theoretical models for description of dielectric - metal transition in polyacetylene are considered. Experimental data on investigation of this transition are discussed. 117 refs.; 35 figs.

11908 **(MU/SBCS—87) Marketing study. Volume 1. Abrasion resistant glass-ceramic tiles for materials handling systems. Volume 2. Abrasion resistant ceramic tiles.** (McMaster Univ., Hamilton, Ontario (Canada). Small Business Consulting Service). [1987]. 110p. (MICROLOG—87-03982). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Research has been conducted by the Ontario Research Foundation and the Canada Centre for Mineral and Energy Technology for developing an abrasion-resistant glass-ceramic tile for use in material handling systems with slag as a principal component. This report examines the marketing implications for this product including competition, applications, success factors and market structure. As well, work done in other countries on slag-ceramics and the research completed in Canada are summarized.

11909 **(N—88-10188) Effect of high-temperature annealing on the microstructure and thermoelectric properties of GaP doped SiGe.** Draper, S.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1987. 23p. (NASA-TM—100164; E—3729; NAS—1.15:100164). NTIS, PC A03/MF A01.

Annealing of GaP doped SiGe will significantly alter the thermoelectric properties of the material resulting in increased performance as measured by the figure of merit Z and the power factor P. The microstructures and corresponding thermoelectric properties after annealing in the 1100 to 1300 C temperature range have been examined to correlate performance improvement with annealing history. The figure of merit and power factor were both improved by homogenizing the material and limiting the amount of cross-doping. Annealing at 1215 C for 100 hr resulted in the best combination of thermoelectric properties with a resultant figure of merit exceeding 1x10 to the -3 deg C to the -1 and a power factor of 44 microW/cm/deg C sq for the temperature range of interest for space power: 400 to 1000 C.

11910 **(N—88-10680) Optimization of SIS mixer elements. Final report.** Mattauch, R.J. (Virginia Univ., Charlottesville (USA)). Dec 1985. 145p. (NASA-CR—180710; NAS—1.26:180710; UVA—528204/EE86/101). NTIS, PC A07/MF A01.

Superconductor-Insulator-Superconductor (SIS) quantum mixers provide an approach to millimeter wave mixing - potentially offering conversion gain, a low local oscillator power demand, and potential mixer noise temperatures near the quantum limit. The development of a reliable fabrication technology for producing such high quality SIS devices for mixer applications in radio astronomy is the focus of the work.

11911 **(N—88-10898) Study of the mechanical behavior of a 2-D carbon-carbon composite.** Avery, W.B.; Herakovich, C.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Aug 1987. 295p. (NASA-CR—181476; NAS—1.26:181476; CCMS—87-13; VPI-E—87-15; IR—66). NTIS, PC A13/MF A01.

The objective of this study was to observe and characterize the out-of-plane fracture of a 2-D carbon-carbon composite and to gain an understanding of the factors influencing the stress distribution in such a laminate. Finite element analysis of a two-ply carbon-carbon composite under in-plane, out-of-plane, and thermal loading were performed. The results indicated that under out-of-plane loading sigma sub x and tau sub xz were strongly dependent on stacking sequence, undulation aspect ratio, and undulation offset ratio, but sigma sub z and sigma sub y were relatively independent of geometry. Under in-plane loading all components of stress were strong functions of geometry. Additionally, large thermal stresses were predicted. Out-of-plane tensile tests revealed that failure was interlaminar, and that cracks propagated along the fiber-matrix interface. An elasticity solution was utilized to analyze an orthotropic fiber in an isotropic matrix under uniform thermal load. The analysis reveals that the stress distributions in a transversely orthotropic fiber are radically different from those predicted assuming the fiber to be transversely isotropic.

11912 **(N—88-10899) Effect of bromination of carbon fibers on the coefficient of thermal expansion of graphite fiber-epoxy composites.** Jaworske, D.A.; Maciag, C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Nov 1987. 6p. (NASA-TM—100236; E—3665-1; NAS—1.15:100236). NTIS, PC A02/MF A01.

To examine the effect of bromination of carbon fibers on the coefficient of thermal expansion (CTE) of carbon fiber epoxy composites, several pristine and brominated carbon fiber-epoxy composite samples were subjected to thermomechanical analysis. The CTE's of these samples were measured in the uniaxial and transverse directions. The CTE was dominated by the fibers in the uniaxial direction, while it was dominated by the matrix in the transverse directions. Bromination had no effect on the CTE of any of the composites. In addition, the CTE of fiber tow was measured in the absence of a polymer matrix, using an extension probe. The results from this technique were inconclusive.

11913 **(N—88-10938) High temperature metal matrix composites for future aerospace systems.** Stephens, J.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1987. 18p. (NASA-TM—100212; E—3821; NAS—1.15:100212; CONF-8710253—). NTIS, PC A03/MF A01.

From ASM international composite session; Cincinnati, OH, USA (13 Oct 1987).

Research was conducted on metal matrix composites and intermetallic matrix composites to understand their behavior under anticipated future operating conditions envisioned for aerospace power and propulsion systems of the 21st century. Extremes in environmental conditions, high temperature, long operating lives, and cyclic conditions dictate that the test evaluations not only include laboratory testing, but simulated flight conditions. The various processing techniques employed to fabricate composites are discussed along with the basic research underway to understand the behavior of high temperature composites, and the relationship of this research to future aerospace systems.

11914 **(ORF—8507) Development of a unified theory for predicting the behaviour of glassy waste products (fly ash, fumed silica, and slags) in concrete and to develop new compositions of concrete for offshore applications.** van Roode, M.; Hemmings, R.T. (Ontario Research Foundation, Sheridan Park (Canada)). Jul 1985. 412p. (MICROLOG—86-01834). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Nine Canadian fly ashes and two blast-furnace slags have been characterized by chemical and mineralogical composition, density, particle size distribution surface area, and glass content. Their structurea have been investigated with x-ray powder diffraction and Fourier Transform Infrared Spectroscopy. Hydration studies have been carried out in deionized H/sub 2/0 and aqueous NaOH solutions. Nine techniques were identified that could be potentially useful for the determination of glass content. Five of these nine have been investigated for their applicability. Quantitative x-ray diffraction gave glass content values in the 53.5-94.5% range while Non-Crystalline Scattering X-Ray Diffraction gave glass content values from 42.8-99.3%. The average over the two techniques was in the 65.6-86.9% range. Electron optical examination in conjunction with energy dispersive x-ray analysis indicated the presence of four different particle types and substantial compositional variation between particles and, to a lesser extent, within a particle. X-ray diffraction studies on model glasses showed the presence of two diffraction maxima for most compositions. Preliminary hydration studies in deionized H/sub 2/0 showed that most glassy waste materials exhibited a rapid rise in pH to alkaline values followed by a decline. The implications for alkalie-aggregate reactivity have been discussed. 55 figs., 55 tabs.

11915 **(ORF/GC—800421) A study of the high temperature electrical conductivities of silicate samples-molten state. Phase 1. Final report.** Reyes, J.M. (Ontario Research Foundation, Mississauga (Canada). Dept. of Glass and Ceramics). 21 Apr 1980. 20p. (MICROLOG—84-1648). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objective was to measure the electrical conductivity of silicates over temperatures 300/sup 0/C to 1500/sup 0/C. This temperature range includes regions where the silicates are solid and regions where they are molten. As such, the program was divided into two phases: the first phase involves the measurement of the electrical conductivity in the molten state up to 1500/sup 0/C, and

the second phase involves the measurement of the electrical conductivity from 300/sup 0/C to the softening point of the solid phase. This report covers the work carried out in Phase 1 of the program. 7 figs.

11916 **(ORF/GC—800930) A study of the high temperature electrical conductivities of silicate samples - molten state. Phase 2. Final report.** Reyes, J.M. (Ontario Research Foundation, Mississauga (Canada). Dept. of Glass and Ceramics). 30 Sep 1980. 27p. (MICROLOG—84-0819). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objective was to measure the electrical conductivity of silicates over the temperature range 300/sup 0/C to 1500/sup 0/C. This range includes regions where the silicates are solid and regions where they are molten. The program was divided into two phases: the first phase involved the measurement of the electrical conductivity in the molten state up to 1500/sup 0/C and the second phase involved the measurement of the electrical conductivity from 300/sup 0/C to the softening point of the solid phase. This report covers the work carried out in the second phase. 12 figs., 10 tabs.

11917 **(ORF/M—840926) Development of a unified theory for predicting the behaviour of glassy waste products (flyash fumed silica and slags) in concrete and to develop new compositions of concrete for offshore applications.** van Roode, M. (Ontario Research Foundation, Sheridan Park (Canada)). 26 Sep 1984. 27p. (MICROLOG—86-01154). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The overall objectives of the EMR Flyash program were to develop a unified theory to predict the behaviour of glassy waste products (flyash, silica fume, and slags), and on the basis of the formulated theory, develop new compositions of concrete for offshore and other marine applications. The specific objective of the first phase was to study the kinetics and mechanism pertaining to the reaction of glassy waste materials with leaching agents including water, alkalies, and other solutions. This report discusses the experimental progress to date. Glass content determinations were carried out on Wabamun flyash using the Differential Intensity Technique. The technique is promising for systems in which the crystalline phases in both the partially and fully crystallized samples are the same and present in the same ratios. The technique as it was developed for organic polymers appears not applicable to flyashes without modifications. 6 figs., 4 tabs.

11918 **(PB—88-106224/XAB) Investigation of the high-strain-rate deformation of SiCw/2124 Al composite.** Harding, J.; Taya, M.; Derby, B.; Pickard, S. (Oxford Univ. (UK). Dept. of Engineering Science). Jul 1987. 14p. (OUEL—1675/87). NTIS, PC E04/MF E04.

The investigation seeks to determine the stress-strain response of a short-fiber metal-matrix composite material having a 2124 aluminum alloy matrix reinforced with SiC whiskers in volume fractions of 15% and 25%. Tests will be performed at room temperature at strain rates from quasi-static (10-3/s) to impact (1500/s). At the impact rates a split Hopkinson's pressure bar system will be used, in the modified form recently developed for the tensile impact testing of continuous fiber reinforced composites with polymeric matrices.

11919 **(PB—88-110176/XAB) Study of composite materials with a vitreous matrix. Final report.** Vignesoult, S. (Saint-Gobain Recherche, Aubervilliers (France)). Oct 1986. 33p. (In French). (SGR/PR—4305/86-SV/JC). NTIS, PC E04/MF E04.

Unidirectional composites with a glassy or vitroceramic matrix and SiC Nicalon fibers were developed by hot pressing. Good mechanical properties could be obtained at room temperature: an elastic module of 100 to 120 GPa stressed to rupture of 600 to 800 MPa, pseudoproducible material. The temperature resistance is at present mediocre. A detailed analysis of the interfacial fiber-matrix relationship should make it possible to resolve this point.

11920 **(PB—88-123716/XAB) Results of the Monte Carlo calculation of one- and two-dimensional distributions of particles and damage: ion-implanted dopants in silicon. Special Pub. (Final).** Albers, J. (National Engineering Lab. (NBS), Washington, DC (USA)). Sep 1987. 675p. (NBS/SP—400/79). NTIS, PC A99/MF E04.

Also available from Supt. of Docs. as SN003-003-02821-5; Library of Congress catalog card no. 87-619864.

The Transport of Ions in Matter (TRIM) Monte Carlo code was used to calculate the two-dimensional distributions of particles, primary damage, and electronic and nuclear energy loss for implantation of a line beam source into silicon targets. Approximate two-dimensional distributions of the Frenkel pairs (vacancy-interstitial) created by the primary displacement damage of the target atoms were calculated by means of the Kinchin-Pease equation. These particle, damage, and energy-loss distributions allowed for the calculation of the one-dimensional distributions of these quantities for implantation into unmasked targets. A superposition technique was used to construct the two-dimensional particle and approximate Frenkel pairs distributions for implantation past a mask edge. The energetic ions used in the calculations were in two groups: those used as intentional dopants in silicon-device fabrication and those that either limited lifetime or acted as gettering sites. The particle distributions were parameterized by means of standard polynomial-fitting techniques.

11921 **(PB—88-853544/XAB) PVC plastics: light stability. January 1973-November 1987 (citations from the Rubber and Plastics Research Association data base). Report for January 1973-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 91p. NTISPC N01/MF N01.

Supersedes PB—86-852175.

This bibliography contains citations concerning the utilization of additives that inhibit photodegradation in polyvinyl chloride (PVC) plastic products. Topics include descriptions and evaluations of specific additives, chemical aspects, and results of controlled-laboratory investigations of the photodegradation of PVC materials. Zinc, titanium, and tin compounds are among the additives discussed. (This updated bibliography contains 200 citations, 52 of which are new entries to the previous edition.)

11922 **(PB—88-853858/XAB) Radiation-curable polymer coatings. January 1970-November 1987 (citations from the US Patent data base). Report for January 1970-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 77p. NTISPC N01/MF N01.

Supersedes PB—86-860509.

This bibliography contains citations of selected patents concerning methods and compositions used in radiation-curable polymer coatings. Protective and decorative coatings on metallic and non-metallic substrates curable with light, including ultraviolet, are disclosed. Abrasion-resistant coating techniques are presented. (This updated bibliography contains 159 citations, 20 of which are new entries to the previous edition.)

11923 **(PB—88-853973/XAB) Graphite: chemical properties. January 1981-November 1987 (citations from the NTIS data base). Report for January 1981-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 136p. NTISPC N01/MF N01.

Supersedes PB—86-866290.

This bibliography contains citations concerning a variety of topics pertaining to the chemistry of graphite. Topics include catalytic studies, sorption and combustion characteristics, and analytical methods employed in the chemical characterization of graphite materials. Specific reaction rates and mechanisms, nuclear-graphite properties, and graphite-substrate analysis are also discussed. Citations pertaining to intercalation compounds are excluded. (This updated bibliography contains 259 citations, 62 of which are new entries to the previous edition.)

11924 **(QU/P—8307) The d...ri...ment of ceramic proton conductors. Final report.** Bell, M... ; Sayer, M. (Queen's Univ., Kingston, Ontario (Canad... Dept. of Physics). Jul 1983. 40p. (MICROLOG—84-0046). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

There has been a continuing interest in the development of ionically conducting solids; the search for hydrogen ion conductors has intensified due to their potential application in a large number of devices including fuel cells and water electrolysis units. This latter application has been demonstrated with a solid polymer electrolyte developed by General Electic. This material is a plastic sheet of perfluorinated sulphonic acid polymer and has a conductivity of 6 x 10/sup -2/Ω/sup -1/cm/sup -1/ when saturated with water. However it is expensive to produce. This report reviews the search for less expensive inorganic hydrogen conductors especially compounds which are stable at 200-300/sup 0/C. The second section discusses the experimental data on proton conductors collected under this contract. 10 figs., 6 tabs.

11925 **(SAND—87-1540C) Stability and metastability in semiconductor strained-layer structures.** Dodson, B.W.; Fritz, I.J.; Picraux, S.T.; Tsao, J.Y. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 14p. (CONF-871124—15). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003308/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

The physics governing stability properties and relaxation of mismatch strain in semiconductor strained-layer structures is reviewed. Experimental data on stablity and rates of strain relaxation are examined. We conclude that essentially all observations on structural relaxation of semiconductor strained-layer structures can be explained by standard models of plastic deformation adapted to the special conditions controlling dislocation dynamics in these structures. 25 refs., 4 figs.

11926 **(SAND—87-1582C) Interactions of implanted carbon with oxygen and nitrogen in silicon.** Stein, H.J. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 6p. (CONF-871124—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003205/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

Carbon has been implanted into Si to overlap implanted concentrations of oxygen and nitrogen. Impurity incorporation and interactions produced by implantation at 50°C, and upon subsequent annealing to 900°C, were monitored by infrared absorption. Implantation with O and C introduces absorption bands for C-O centers in addition to those for substitutional C, interstitial O, and O-vacancy centers. These centers are removed by annealing. The major effect of C in N-implanted layers is a suppression of absorption bands associated previously with N aggregates. There is, apparently, a strong interaction between C and displacement defects which can alter defect reordering and control the loss of C from substitutional sites. 10 refs., 5 figs.

11927 **(SAND—87-1885) Residual stiffness and strength of Kevlar/epoxy laminates impulsively loaded to 7.9 ktaps.** Guess, T.R. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003724/JAW.

An experimental investigation of impulse-damaged composites is described. The purpose was to assess material property degradation in Kevlar/epoxy composites that had been subjected to impulse loads up to about 7.9 ktaps. These impulse loads produced intense short-duration compressive stress waves in flat composite panels. In most tests 25% to 45% of the initial composite thickness was delaminated (spalled) and removed from the back surface of the target. Optical inspection of residual target material did not reveal any matrix microcracking or delaminations away from the immediate vicinity of the spall surface of 0.125 and 0.25 inch thick targets; the 0.5 inch thick targets had some tensile stress induced delaminations. Specimens cut from residual targets and from as-fabricated materials were tested in tension, compression, four-point bend and three-point bend. There was basically no difference between the stress-strain responses of residual, impacted composite and as-fabricated composite samples. The load carrying capacity of the residual, impacted composites was reduced in proportion to the thickness of the material removed by spallation. Predictions of composite elastic properties were in good agreement with experimental values. Combined evidence of optical inspection and experimental results suggests that intense compression stresses did not significantly degrade the basic lamina properties of the Kevlar/epoxy composites investigated. 12 refs., 7 figs., 7 tabs.

11928 **(SAND—87-2589C) Optical characterization of GaAs/sub 1-x/Sb/sub x/ and GaAs/sub 1-x/Sb/sub x// GaAs strained layer superlattices.** Klem, J.F.; Huang, D.; Morkoc, H.; Ihm, Y.E.; Otsuka, N. (Sandia National Labs., Albuquerque, NM (USA); Illinois Univ., Urbana (USA). Coordinated Science Lab.; Purdue Univ., Lafayette, IN (USA). School of Materials Engineering). 1987. Contract AC04-76DP00789. 19p. (CONF-880110—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003393/JAW.

From SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, CA, USA (10 Jan 1988).

Molecular beam epitaxy has been used to grow both GaAs/sub 0.5/Sb/sub 0.5/ films lattice-matched to InP and GaAs/sub 1-x/Sb/sub x//GaAs strained layer superlattices on GaAs substrates. Films grown on InP substrates are of a composition inside the well-known solid-phase miscibility gap for this alloy. Because these films are metastable, they exhibit an unusual microstructure which includes both ordering and clustering effects. Nevertheless, we have obtained low-temperature photoluminescence linewidths of under 8 MeV. This represents the best linewidth for this material reported to data. Correlations between film microstructure and the optical quality of these alloys have been observed.

11929 **(UCID—21259) Flash threshold of shocked aluminum silicofluoride.** Bloom, G.H. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003978/JAW.

For a 0.5-mm polycarbonate flier striking a 0.5-mm polycarbonate target, we found that a velocity of 1.42 km/s was necessary to cause aluminum silicofluoride sprayed on the far surface to flash. We calculated that the pressure in the polycarbonate was 2.93 GPa. 5 refs., 2 figs.

11930 **(UCID—21273) F.E.L. coolant.** Schumann, D.; Lepper, J. (Lawrence Livermore National Lab., CA (USA)). 20 Nov 1987. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003977/JAW.

The compatibility of a number of organic and inorganic materials with Freon-113 in ETA-II is studied. The stability of Freon-113 in the simulated electrical environment is also discussed. It would be desirable to use Freon-113 as the dielectric coolant because it is a factor of twenty less expensive than the currently used Flourinert-75. No substantial problems were observed with any of the materials of interest. Polycarbonate will craze under certain conditions of exposure to Freon-113, mechanical stress, temperature and time. Extruded polymethylmethacrylate crazes on exposure to Freon-113. This is assumed to result from residual stress or processing aids because the cast polymer shows no effects. The polysiloxane swelled severely in the Freon-113 which is no surprise since solubility parameters are close. The Freon-113 did not break down under electrical arcing which simulated service conditions to produce HF or HCl within the detection limits of a Karl Fisher titration even with substantial added water.

11931 (UCRL—97277) Corner compensation structures for (110) oriented silicon. Ciarlo, D.R. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 9p. (CONF-8711113—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003300/JAW.

From Micro robots and teleoperators workshop; Hyannis, MA, USA (9 Nov 1987).

We have studied the use of (110) oriented silicon wafers for the fabrication of microscale mechanisms such as cantilever beams and latching mechanisms. Using this orientation, cantilever beams can be fabricated such that they deflect in a parallel direction to the wafer surface. It might be possible to fabricate structures such as setback accelerometers and latching mechanisms with (110) silicon cantilevers. We have designed and fabricated corner compensation structures for use with (110) oriented cantilever beams. 6 refs., 4 figs.

11932 Plasmon-phonon-assisted electron-hole recombination in silicon at high laser fluence. Rasolt, M.; Malvezzi, A.M.; Kurz, H. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 and Department of Physics, Harvard University, Cambridge, Massachusetts 02138). *Applied Physics Letters;* 51: No. 26, 2208-2210(28 Dec 1987). Contract AC05-84OR21400.

We present both theoretical and experimental results in silicon which clearly demonstrate that at time scales of 20 to 40 ps, after the pump laser pulse and at fluences greater than 100 mJ/cm^2, the carrier density of the electron-hole plasma drops for increasing fluence; this is not explained by Auger recombination. We show that this drop is specific to plasmon-phonon-assisted recombination, which naturally explains this behavior.

11933 Measurement of local structural configurations associated with reversible photostructural changes in arsenic trisulfide films. Yang, C.Y.; Paesler, M.A.; Sayers, D.E. (Department of Physics, North Carolina State University, Raleigh, North Carolina 27695-8202). *Physical Review* [*Section*] *B: Condensed Matter;* 36: No. 17, 9160-9167(15 Dec 1987).

Extended x-ray-absorption fine-structure measurements have been made on three reversible and reproducible cycles of thermally annealed and light-soaked amorphous As_2S_3 films. Associated with the light-soaked material are (1) a very small increase in the population of wrong bonds in the first shell, (2) an enlarged As: S: As bond angle with an expansion of As: As distance in the second shell, (3) a larger spread in the distribution of As: S: As bond angles, and (4) an absence of any change in the third As: S shell. From these data, we present the first quantitative correlation between observed local atomic structural changes and measured macroscopic properties that are associated with photodarkening. Our data demonstrate that the photoinduced structural changes mainly involve bonding alterations at S atoms as well as a change in the dihedral angle relationship between adjacent AsS_3 pyramids joined at S atoms.

11934 In situ optical-reflectance study of H_2 physisorption in C/sub 24/K. Doll, G.L.; Eklund, P.C. (Department of Physics and Astronomy, University of Kentucky, Lexington, Kentucky 40506-0055). *Physical Review* [*Section*] *B: Condensed Matter;* 36: No. 17, 9191-9195(15 Dec 1987).

An in situ study of the optical reflectance of a second-stage graphite-potassium compound undergoing adsorption of hydrogen gas at T = 77 K is presented. From the small shift in the position of the Drude edge in the reflectance spectrum due to the hydrogen uptake we find the resulting electron backdonation (f/sub B/) to be less than 0.020 electron per K atom, or 0.0065 electron per H atom. This low value of f/sub B/ indicates that the T = 77 K adsorption of hydrogen into the stage-2 graphite-K compound is consistent with the traditional view of physisorption of the molecular species (H_2) in which the adsorbed molecules are attracted to the host's lattice via a van der Waals interaction.

11935 Critical criterion for axial models of defects in as-grown n-type GaAs. Nolte, D.D.; Walukiewicz, W.; Haller, E.E. (Center for Advanced Materials, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* 36: No. 17, 9374-9377(15 Dec 1987).

Using the recently determined band-edge hydrostatic deformation potentials of GaAs we provide for the first time values for the change in the strength of the isotropic strain coupling of several defects upon electron emission. We further present uniaxial stress deep level transient spectroscopy data on EL2 and EL6 in as-grown n-type GaAs and obtain upper bounds for the axial deformation potentials. The ratio of the change in the isotropic strain-coupling strength to the change in the axial strain coupling for these defects is a critical criterion which must be satisfied by theoretical models that successfully describe axial defects.

11936 Common-anion rule and its limits: Photoemission studies of CuIn/sub x/Ga/sub 1-//sub x/Se_2-Ge and Cu/sub x/Ag/sub 1-//sub x/$InSe_2$-Ge interfaces. Kilday, D.G.; Margaritondo, G.; Ciszek, T.F.; Deb, S.K.; Wei, S.h.; Zunger, A. (Department of Physics and Synchrotron Radiation Center, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review* [*Section*] *B: Condensed Matter;* 36: No. 17, 9388-9391(15 Dec 1987).

Synchrotron-radiation photoemission data show that the valence-band discontinuities of CuIn/sub x/Ga/sub 1-//sub x/Se_2-Ge and Cu/sub x/Ag/sub 1-//sub x/$InSe_2$-Ge interfaces are independent of x within the experimental accuracy of 0.1 eV. We argue that this result is consistent with the Wei-Zunger explanation of the breakdown of the common-anion rule, which is based on a substantial role of the cation d states in determining the valence-band-edge position.

11937 Deep-level defects in silicon and the band-edge hydrostatic deformation potentials. Nolte, D.D.; Walukiewicz, W.; Haller, E.E. (Center for Advanced Materials, Lawrence Berkeley Laboratory and University of California, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* 36: No. 17, 9392-9394(15 Dec 1987).

Evidence for an energy reference level based on substitutional transition-metal defect levels in semiconductors is presented and used to obtain the values for the band-edge hydrostatic deformation potentials in silicon. From the pressure derivatives of Pt and Pd acceptors in silicon we derive values of γ/sub d/ = -0.5 eV and a/sub v/ = +0.9 eV. These values are consistent with recent theoretical calculations and with the analysis of acoustic-phonon-limited electron and hole mobility.

11938 Application of the embedded-atom method to covalent materials: A semiempirical potential for silicon. Baskes, M.I. (Sandia National Laboratories, Livermore, California 94550). *Physical Review Letters;* 59: No. 23, 2666-2669(7 Dec 1987).

The embedded-atom method, a semiempirical theory of metal bonding, is investigated as a method to calculate the bonding in a covalent material. A simple first-neighbor embedded-atom method model is sufficient to explain the geometry and structure of many metastable phases of silicon, but not its shear behavior. To obtain realistic shear behavior of silicon, an angle-dependent electron density is included to model the effects of bond bending. This model uses only the experimental bulk properties of silicon. Calculated properties of metastable phases and point defects are presented.

11939 Pressure-induced structural phase transitions in solid xenon. Jephcoat, A.P.; Mao, H.; Finger, L.W.; Cox, D.E.; Hemley, R.J.; Zha, C. (Geophysical Laboratory, Carnegie Institution of Washington, Washington, DC 20008-3898, New York 11973). *Physical Review Letters;* 59: No. 23, 2670-2673(7 Dec 1987).

Pressure-induced structural phase transitions have been observed in solid xenon by high-pressure x-ray diffraction methods up to 137 GPa (1.37 Mbar). The face-centered-cubic structure is unstable above 14 GPa and transforms to an intermediate, close-packed phase. Above 75 GPa a further transition takes place to the hexagonal-close-packed structure which remains stable to at least 137 GPa. At this pressure, where V = 10.5 +- 0.2 cm^3/mol (V/V/sub 01/ = 0.30), there is no evidence for band-gap closure.

11940 **Ferroelectric transition in Pb/sub 1-//sub x/Ge/sub x/Te: Extended x-ray-absorption fine-structure investigation of the Ge and Pb sites.** Islam, Q.T.; Bunker, B.A. (University of Notre Dame, Notre Dame, Indiana 46556). *Physical Review Letters;* 59: No. 23, 2701-2704(7 Dec 1987).

Extended x-ray-absorption fine-structure measurements have been made on the Ge and Pb edges of ferroelectric Pb/sub 1-//sub x/Ge/sub x/Te disordered alloys. Our results show that Ge atoms are displaced approximately 0.8 A from the cell center both below and above the transition, implying that the ferroelectric transition involves long-range ordering of the dipoles. We have also measured the displacement of the Pb sublattice relative to the Te sublattice, thus showing evidence for a simultaneously order-disorder and displacive transition.

11941 **Velocity selection at large undercooling in a two-dimensional nonlocal model of solidification.** Barbieri, A. (Physics Department, University of California, Santa Barbara, California 93106). *Physical Review [Section] A: General Physics;* 36: No. 11, 5353-5358(1 Dec 1987).

In this paper we consider the two-dimensional symmetric model of dendritic solidification with capillary anisotropy in the limit of large undercooling. We show that capillary anisotropy is necessary to obtain steady-state solutions, and that it allows the system to select a particular value of the growth velocity. The results obtained are in complete agreement with what has been derived in the corresponding limit in the case of the boundary-layer model.

11942 **Critical stresses for Si/sub x/Ge/sub 1-//sub x/ strained-layer plasticity.** Tsao, J.Y.; Dodson, B.W.; Picraux, S.T.; Cornelison, D.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* 59: No. 21, 2455-2458(23 Nov 1987).

We have measured the temperature-dependent onset of strain relief in metastable Si/sub x/Ge/sub 1-//sub x/ strained layers grown on Ge substrates. On the basis of these measurements, and physical arguments, we propose that strained-layer breakdown is most directly determined not by thickness and lattice mismatch, but rather by (1) an "excess" stress (the difference between that due to misfit strain and that due to dislocation line tension) and (2) temperature. With use of these parameters, observed regimes of stability and metastability are shown to be described within a simple, unified framework.

11943 **Domain structure in epitaxial metastable zinc-blende (GaAs)/sub 1-//sub x/(Ge$_2$)/sub x/(001) alloys.** Romano, L.T.; Robertson, I.M.; Greene, J.E.; Sundgren, J.E. (Department of Materials Science, the Coordinated Science Laboratory the Materials Research Laboratory, University of Illinois, 1101 West Springfield Avenue, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* 36: No. 14, 7523-7528(15 Nov 1987). Contract AC02-76ER01198.

Plane-view and cross-sectional transmission electron microscopy have been used to examine the structure of epitaxial metastable zinc-blende (GaAs)/sub 1-//sub x/(Ge$_2$)/sub x/ alloys grown by rf sputter deposition on GaAs(001) substrates. An analysis of bright-field and dark-field images obtained from both fundamental and superstructure reflections showed, in addition to (111) microtwins and (a/2)<110> line dislocations, the existence of ordered antiphase regions. However, the domain boundaries were not composed of Ga: Ga and As: As antisite bonds, as in III-V films grown on group-IV substrates, but formed stochastically due to the presence of Ge in agreement with previously published theoretical growth kinetic models. The Ge-mediated boundaries were planar and gave rise to an additional contrast in dark-field images obtained with {002} superstructure reflections. From cross-sectional micrographs and plane-view images obtained with samples tilted away from the [001] zone axis, the antiphase regions were shown to extend primarily parallel to the growth direction but with random off-axis components weaving through the matrix. The spatial extent and number density of these domains increased with increasing Ge concentrations.

11944 **Electron-diffraction study of $SbCl_5$-intercalated graphite.** Mittleman, R.K.; Parker, N.W.; Crewe, A.V. (The Enrico Fermi Institute, The University of Chicago, 5640 S. Ellis Avenue, Chicago, Illinois 60637). *Physical Review [Section] B: Condensed Matter;* 36: No. 14, 7590-7600(15 Nov 1987).

Using high-resolution electron diffraction we have studied the in-plane superlattice structure of stage-2, -3, and -4 antimony pentachloride—intercalated graphite. We used an analytical scanning transmission electron microscope with a microdiffraction resolution of 100 A. The samples were examined over a wide temperature range (77—295 K) with no indication of any phase change. Two previously unknown long-range superlattices, with structures ($\sqrt{31}$ x $\sqrt{31}$)R +- 8.95° and ($\sqrt{19}$ x $\sqrt{19}$)R +- 23.4°, and unit cells with long-range molecular orientational ordering were found.

11945 **Thermal conductivity and specific heat of glasses.** Yu, C.C.; Freeman, J.J. (Los Alamos National Laboratory (T-11, Mail Stop B262), Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* 36: No. 14, 7620-7624(15 Nov 1987).

We present a simple phenomenological model for glasses which fits both the thermal conductivity κ and the specific heat C up to roughly 100 K. This includes the plateau in κ as well as the maximum in C/T^3 which occur between 3—10 K. In addition to conventional tunneling systems and Rayleigh scattering, we introduce a sharp increase in the density of states due to local excitations. This feature is consistent with both Raman and neutron scattering. The absence of these states at low frequencies is due to interactions between the local modes and phonons.

11946 **Trigonal hydrogen-related acceptor complexes in germanium.** Kahn, J.M.; McMurray R.E. Jr.; Haller, E.E.; Falicov, L.M. (University of California and Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* 36: No. 15, 8001-8014(15 Nov 1987).

In germanium, an interstitial hydrogen atom may bind at a substitutional atom of carbon, silicon, beryllium, or zinc to form a shallow, monovalent acceptor complex. Photothermal ionization spectroscopy under uniaxial stress reveals that the complexes A(H,C), A(H,Si), A(Be,H), and A(Zn,H) have trigonal (C_{3v}) symmetry. Each has two (1s)-like acceptor levels which shift, but do not split, under stress. In the fourfold basis for a Γ_8(T) level, simultaneous diagonalization of the perturbations of applied stress, and of a trigonal lowering of symmetry, yields theoretical piezo- spectroscopic behavior in quantitative agreement with all available experimental data. This procedure has been extended to predict the stress-induced shifts of (1s)-like shallow acceptor levels associated with tetragonal (D_{2d}) and rhombic-I (C_{2v}) complexes in germanium, should these ever be observed experimentally. The four trigonal complexes in germanium are to be contrasted with A(Be,H) in silicon, in which the rapid tunneling of hydrogen leads to recovery of tetrahedral symmetry and a much more complicated energy-level structure.

11947 **Magnetoquantum oscillations, magnetic breakdown, and Fermi-surface modifications in $NbSe_3$.** Everson, M.P.; Johnson, A.; Lu, H.; Coleman, R.V.; Falicov, L.M. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). *Physical Review [Section] B: Condensed Matter;* 36: No. 13, 6953-6962(1 Nov 1987).

The magnetoquantum oscillations in $NbSe_3$ show frequency shifts and beat structures due to interaction between the pinned charge-density-wave (CDW) configuration and the normal Fermi surface (FS). Spatial variations in the phase deformation of the CDW pinned at impurities can result in changes in the local Fermi level and CDW gap, giving rise to a distribution of extremal FS areas. Magnetic breakdown (MB) between these small FS sections and the open nested sheets of FS can have striking effects on the amplitude and frequency of the quantum oscillations due to modulation of the transmission and reflection coefficients at the MB junctions. A model using a one-dimensional open-orbit network and a rectangular distribution of FS areas has been used to fit the data in $\rho_{b,c}$ range 0—225 kG. Good fits to the beat periods and frequency

shifts are obtained and provide an accurate measure of the width of the frequency distribution for different CDW configurations. The existence of these MB mechanisms also provides an explanation for hysteresis and asymmetry observed in the magnetoresistance as the CDW configuration is manipulated in electric and magnetic fields.

11948 **Magnons and fractons in the diluted antiferromagnet Mn/sub x/Zn/sub 1-//sub x/F_2.** Uemura, Y.J.; Birgeneau, R.J. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **36**: No. 13, 7024-7035(1 Nov 1987). Contract AC02-76CH00016.

We report high-resolution inelastic-neutron-scattering studies of the spin dynamics in the diluted near-Heisenberg antiferromagnet Mn/sub x/Zn/sub 1-//sub x/F_2 with x = 0.75 and 0.50. The x = 0.75 experiments reproduce previous results by Coombs et al. [J. Phys. C 9, 2167 (1976)], albeit with much higher resolution. In that case the excitations may be described as spin waves which broaden progressively as the wave vector approaches the zone-boundary value q/sub ZB/. However, even at q/sub ZB/ the excitation is underdamped. More interesting behavior is observed in the x = 0.50 sample. At long wavelengths, the response function $S(q,\omega)$ is dominated by a sharp spin-wave peak; however, there is a weak ω/sup -3/ tail extending to high energies. With increasing wave vector the sharp peak diminishes in intensity while a broad overdamped component, which is well described by a damped-harmonic-oscillator (DHO) function, grows in intensity. The crossover from a dominant spin wave to a dominant DHO response occurs for q~0.3q/sub ZB/. In energy space, this phenomenon manifests itself as a crossover from propagating low-energy spin waves to localized high-energy excitations. An independent measurement of elastic diffuse magnetic scattering from the x = 0.50 sample yields the percolation correlation length ξ/sub p/ associated with the dilution as ξ/sub p//sup -1/ = 0.3q/sub ZB/. This demonstrates that the crossover in the dynamics occurs at the length scale characteristic of the static geometrical disorder. The results are thence related to the magnon-fracton crossover predicted by recent theories for percolation networks.

11949 **Suppression of superconductivity by antiferromagnetism in $Tm_2Fe_3Si_5$.** Gotaas, J.A.; Lynn, J.W.; Shelton, R.N.; Klavins, P.; Braun, H.F. (Institute for Materials Science and Engineering, National Bureau of Standards, Gaithersburg, Maryland 20899). *Physical Review [Section] B: Condensed Matter;* **36**: No. 13, 7277-7280(1 Nov 1987).

Powder neutron diffraction experiments at pressures up to 8.2 kbar and temperatures down to 0.3 K have been performed on the antiferromagnetic ternary compound $Tm_2Fe_3Si_5$. For pressures between 2 and 21 kbar, this system becomes superconducting at T/sub c/$_1$>T/sub N/, with a subsequent reentrance to the normal conducting state at T/sub c/$_2$<T/sub N/. Our measurements demonstrate that the antiferromagnetic structure is unchanged under pressure, with no evidence for a ferromagnetic component at any pressure that would compete with the superconducting phase. This is the first experimental observation of the quenching of superconductivity by a purely antiferromagnetic state.

11950 **Neutron scattering study of magnetic excitations in intercalated $CoCl_2$.** Zabel, H.; Shapiro, S.M. (Department of Physics, 1110 West Green Street, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **36**: No. 13, 7292-7295(1 Nov 1987).

We have studied by inelastic neutron scattering the magnetic excitations of $CoCl_2$ layers intercalated in graphite. At 4.5 K the stage-2 compound exhibits ferromagnetic xy-type interactions within the Co/sup 2+/ sheets, which are weakly antiferromagnetically coupled along the hexagonal c axis. The magnon dispersion curve was measured for spin waves propagating within the basal planes up to the first powder-averaged Brillouin zone. At small wave vectors, a splitting of the branch occurs, indicative of weak interplanar coupling. A fit to the measured excitation energies yields exchange and anisotropy parameters which are in good agreement with susceptibility data.

11951 **Acid rain and weathering damage to carbonate building stone.** Reddy, M.M.; Youngdahl, C.A. (U.S. Dept. of the Interior, Geological Survey, MS 407, Box 25046, Denver, CO). *Materials Performance;* **26**: No. 7, 33-36(Jul 1987).

Marble and limestone specimens were exposed to atmospheric conditions at four eastern US sites. A number of methods were used for damage assessment; this paper describes the results of chemical and physical measurements of material loss. Good agreement was observed among the results obtained with different methods. A surface recession rate near 15 μm/y was observed for skyward surfaces of marble tested in NC, and comparable results were obtained at the other test sites. The response of the porous limestone was assessed with greater difficulty; a loss rate similar to that of marble was inferred. Initial correlations of material loss with environmental factors are briefly discussed.

11952 **A tem study of α''-Fe/sub 16/N/sub 2/ and γ'-Fe/sub 4/N precipitation in iron-nitrogen.** Dahmen, U.; Ferguson, P.; Westmacott, K.H. (National Center for Electron Microscopy, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). *Acta Metallurgica;* **35**: No. 5, 1037-1046(May 1987). Contract AC03-76SF00098.

Precipitation of α''-Fe/sub 16/N/sub 2/ and γ-Fe/sub 4/N in thin foil and bulk-aged nitrogen-ferrite was studied by in situ HVEM and conventional TEM techniques. Detailed analyses of the precipitate morphology, symmetry, and internal fine structure, have led to improved understanding of the factors controlling growth habits.

11953 **The role of ion/surface interactions and photo-induced reactions during film growth from the vapor phase.** Greene, J.E.; Motooka, T.; Sundgren, J.E.; Lubben, D.; Gorbatkin, S.; Barnett, S.A. (Departments of Materials Science, The Coordinated Science Lab., and The Materials Research Lab., Univ. of Illinois, 1101 West Springfield Avenue, Urbana, IL 61801). pp 226-242 of Particle and photon interactions with surfaces. Gruen, D.M.; Krauss, A.R.; Pellin, M.J.; Young, C.E. New York, NY; Elsevier Science Pub. Co. Inc. (1987). (CONF-860807—). Contract AC02-76ER01198.

From 6. international workshop on inelastic ion surface collisions; Argonne, IL, USA (25 Aug 1986).

Recent progress in the understanding of mechanisms associated with low-energy (often <100 eV) ion/surface interactions and photo-induced reactions during vapor-phase crystal growth are reviewed. Ion/surface interactions play an important role in a variety of deposition technologies including sputtering, plasma-assisted chemical vapor deposition, and, more recently, molecular beam epitaxy. Effects such as trapping, preferential sputtering, and collisional mixing are used to interpret and, in some cases, model experimental results concerning the effects of low-energy ion bombardment on nucleation and film growth kinetics, the evolution of film microstructure, elemental incorporation probabilities, surface segregation rates, and dopant depth distributions. The role of photo-stimulated gas-phase and surface reactions during laser-assisted chemical vapor deposition, including single, multiple, and multiphoton-initiated processes, radical production, and adlayer photochemistry, are also discussed together with newly developed laser-processing techniques during deposition. The focus of this review is on the development of an understanding of the controlling mechanisms in both ion/surface and photo-stimulated processes.

11954 **Simple recipe for formation or recovery at ambient pressure of the 8K superconducting state of β-(BEDT-TTF)$_2$$I_3$.** Schirber, J.E.; Azevedo, L.J.; Kwak, J.F.; Venturini, E.L.; Beno, M.A.; Wang, H.H.; Williams, J.M. (Sandia National Labs., Albuquerque, NM, USA; Argonne National Lab., IL, USA). *Solid State Communications;* **59**: No. 8, 525-526(Aug 1986).

A simple recipe for the formation and recovery at ambient pressure of the 8K superconducting state of β-(BEDT-TTF)$_2$$I_3$ is described. This technique will facilitate detailed studies of the 8K state.

11955 **Phonon properties of vanadium-substituted lanthanum niobate derived from heat-capacity measurements.** Nevitt, M.V.; Knapp, G.S. (Argonne National Lab., IL, USA). *Journal of Physics and Chemistry of Solids;* 47: No. 5, 501-505(1986).

We have measured the 3-400 K heat capacity of vanadium-substituted lanthanum niobate LaNbsub(1-x)Vsub(x)O4 (0<x<=0.35) to determine how the relevant averaged properties, or moments, of the phonon spectrum <σsup(n)> relate to certain other lattice properties of these compounds, most noteworthy of which is a large decrease in the paraelastic-ferroelastic transformation temperature Tsub(c) with x. The pertinent moments, represented by their corresponding Debye temperatures, are thetasub(D)(-3) corresponding to the lowest frequency modes; thetasub(D)(theta) associated with the geometric mean frequency of the entire spectrum; and thetasub(D)(2) identified with the high-frequency modes that are sampled at the upper end of the temperature range. We find that thetasub(D)(-3) falls rapidly with x and this effect can be correlated with the comparably sharp drop in Tsub(c). There is little effect of composition on thetasub(D)(theta) and thetasub(D)(2) because the phonons that govern soft-mode behavior represent only a small fraction of the mode population. In the vicinity of Tsub(c) the temperature dependences of the free energies of the tetragonal and monoclinic phases are so similar that the discontinuity in Csub(p) is immeasurably small.

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REFER ALSO TO CITATION(S) 10721, 10932, 11062, 11063, 11064, 11076, 11110, 11885, 12293, 12319, 12569, 12570, 12604, 12606, 12742, 12914, 12938, 12954

11956 **(BARC—1356) Spectrographic determination of Si, Fe and Mn in nuclear grade boron carbide.** Marathe, S.M.; Biswas, S.S.; Narayanan, O.; Murty, P.S. (Bhabha Atomic Research Centre, Bombay, India. Spectroscopy Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701241/JAW.

A spectrographic method is developed to determine Si, Fe and Mn in nuclear grade boron carbide. Boron carbide sample is ground to fine mesh in the presence of liquid N/sub 2/ and mixed with pure conducting graphite powder in the ratio of 1:1 by weight. Ten milligrammes of the ground charge are loaded in the cavity of a U.C.C. 1991 shallow cup electrode (anode) and arced against a 1/8 inch dia. pointed graphite electrode (cathode) at 15 amp d.c. operated in oxygen atmosphere. Synthetic standards are also arced under the same conditions. The spectra are recorded on a 3.4 m JACO Ebert plane grating spectrograph with 30,000 l.p.i. grating in the wavelength region 2300-2900 A, first order. Si 2506.9 A, Fe 2598.4 A and Mn 2605.7 A lines are used as the analytical lines with BO band head at 2437.1 A as the internal standard line. Si and Fe are estimated in the concentration range, 200-5000 ppm and Mn is estimated in the range, 10-500 ppm. 3 figures, 2 tables, 3 refs.

11957 **(CIEMAT—600) Experimental autoabsorption curve /sup 90/Sr in SrCO/sub 3/. Efficiency calculation to detection of /sup 90/Sr, /sup 90/Y and /sup 90/Sr + /sup 90/Y in a beta gas proportional counter.** Gasco, C.; Alvarez, A. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 33p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701255/JAW.

Strontium-90 has been determined by radiochemical separation techniques in environmental samples. These techniques, of course, cannot separate the two strontium radionuclides from each other of from stable strontium. Consequently the end product of the chemical separation contains all strontium isotopes in SrCO/sub 3/. The beta particules emitted by /sup 90/Sr are absorbed by the SrCO/sub 3/ precipitate. This is the main source of error in the activity measurement. It has been prepared sources of /sup 90/Sr in SrCO/sub 3/ in order to determinate the counting efficiency and autoabsorption curve. Also detection efficiencies have been calibrated using known activities of /sup 90/Y and equilibrium mixture of /sup 90/Sr+/sup 90/Y in the same geometry than our samples. The activity of /sup 90/Sr by ingrowth of /sup 90/Y has been calculated by our computer program. (author). 2 figs., 3 refs.

11958 **(CIEMAT—601) Spectral analysis of colour-quenched and chemically quenched C 14 samples.** Grau Malonda, A.; Scott Guillearrd, P.E. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 19p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701256/JAW.

Pairs of pulse height distribution curves, of C-14 samples, colour quenched and chemically quenched were obtained. The possibility to choose a counting window in order to obtain the counting efficiency curves, for both type of quenching was studied. (author). 7 figs., 7 refs.

11959 **(CIEMAT—602) Analysis of polycyclic aromatic hydrocarbons. I. Determination by gas chromatography with glass and fused solica capillary columns.** Perez Garcia, M.; Gonzalez, D. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 7p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701257/JAW.

A study of the analysis by gas chromatography of aromatic polycyclic hydrocarbons is presented. The separation has been carried out by glass and fused silice capillary column. The limitations and the advantages of the procedure are discussed in terms of separation efficiency, sensitivity and precision. (author). 3 figs., 17 refs.

11960 **(DEMO—87/2G) Trace element determination using instrumental neutron activation analysis (INAA).** Tarenidis, D.; Synetos, S. (Institute of Geology and Mineral Exploration, Athens, Greece). (National Research Centre for the Physical Sciences Democritos, Athens (Greece)). Feb 1987. 25p. (In Greek). NTIS (US Sales Only), PC A02/MF A01 - Library, Democritus NRCPS. Order Number TI88701263/JAW.

Neutron activation analysis technique is used to determine trace elements in geological samples. In the present work the conditions of sample preparation, irradiation and counting are established so that optimum results are obtained. Finally the concentrations for 24 trace elements detected in international standards of basalt and granite are given and compared to the internationally accepted values.

11961 **(DOE/OR/21400—T323) Investigation of matrix effects on the neutral fractions ejected from ion-bombarded, uranium-containing solids using resonance ionization mass spectrometry.** Christie, W.H.; Goeringer, D.E. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88000594/JAW.

Resonance ionization mass spectrometry (RIMS) has been used to investigate matrix effects on the yields of U, UO, and UO_2 neutrals desorbed from ion-bombarded, uranium-containing solids. The yield of corresponding secondary ions was also examined by secondary ion mass spectrometry (SIMS). Samples studied were uranium metal, UO_2 (polycrystalline and single crystal), and U_3O_8. Results indicate that the ratio of atomic neutrals to ions in the sputtered plume is quite sensitive to sample composition and surface contamination. The ratio of ground-state U atoms to ions (U^0/U^+) for Ar^+ sputtering from a clean U metal surface is estimated as 2.8×10^3 and the corresponding ratio for UO_2 as 6.2×10^1. 1 ref., 1 fig., 2 tabs.

11962 **(ENEA-RT-TIB—85-4) Rare earths in environment and geologic samples determined by neutron activation analysis.** Moauro, A.; Madaro, M. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1985. 11p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701273/JAW.

Neutron activation analysis allows to determine rare earth elements (REE) with a sensivity much higher than non-nuclear

methods. In this work, this technique has been applied to the determination of REE in environmental samples, such as marine suspended particulate matter and sea, lake and river sediments. The importance of lanthanides in the environmental field is due to the fact that some REE, because of their nearly identical physicochemical behaviour, can simulate the environmental behaviour of actinides, generated by activation or fission processes. Am(III) can be simulated by Eu(III) and Nd(III), that can simulate also Cm(III). As regardes REE in geological studies, their distribution and fractionation in rocks provide information about the genesis and the evolution of the rocks themselves. In this work, some data relevant to Kenya rocks are presented.

11963 (INIS-mf—11051, pp 67-84) **Nonactivation interaction techniques in the analysis of environmental samples.** Toelgyessy, J. (Slovenska Vysoka Skola Technicka, Bratislava, Czechoslovakia. Chemickotechnologicka Fakulta). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700806/JAW. (CONF-8606367—).

From Symposium on interekotechnika; Bratislava, Czechoslovakia (25 Jun 1986).

An overview is presented of nuclear techniques used in the chemical analysis of environmental samples, other than activation analysis and nuclear reaction analysis. Only those methods are discussed which involve the interaction of X-rays or nuclear radiation with a sample containing no radionuclides. The principles of the following methods are explained and their applications described: analysis by charged-particle elastic scattering, absorption of beta radiation, backscattering of beta radiation, gamma absorption and backscattering, X-ray fluorescence analysis, neutron absorption analysis, and analysis using the ionization of gases. (A.K.).

11964 (INIS-mf—11079) **Handbook of nuclear data for neutron activation analysis. Vol. I. Evaluation of gamma-ray spectra.** Hnatowicz, V. (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1986. 196p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88700821/JAW.

The first part of a two-volume book which is meant for experimentalists working in instrumental activation analysis and related fields, such as nuclear metrology, materials testing and environmental studies. The volume describes the basic processes of gamma-ray interaction with matter as well as the important phenomena affecting gamma-ray spectra formation in semiconductor spectrometers. A brief account is also given of computation methods commonly employed for spectra evaluation. The results rather than detailed derivations are stressed. A great deal of material si divided into five chapters and nine appendices. The inclusion of many tables of significant spectroscopic data should make the text a useful handbook for those dealing with multi-channel gamma-ray spectra. (author) 26 figs., 82 tabs., 334 refs.

11965 (INIS-mf—11091) **Qualitative analysis of As, Ba, Cd, Cr, Zn, Fe, Mn, K, Hg, Pb y Cu, as constituents of Amatitlan Lake sediment by XRF.** Beltran, P.A.E.; Morales, E.A. (Section Industrial de la Direccion General de Energia Nuclear, Guatemala). (Universidad de San Carlos de Guatemala, Guatemala City. Facultad de Ciencias Quimicas y Farmacia). Oct 1987. 42p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701314/JAW.

Samples of fifteen sampling points were analyzed. Molybdenum X-ray tube with secondary excitation assembly, SiLi detector and deconvolution software AXIL were employed; self-standardization method based upon incoherent ratio was used for quantitative analysis of some elements. Ca, P, S, Ti, Mn, Fe, Cr, Zn, Cu, Ni, Ga, As, Pb, Ge, Sr and Pb, were found. As, Pb and Cu concentrations lower than 109 mg/lt, 119 mg/lt, and 500mg/lt, respectively, were measured. Hg was not detected.

11966 (INIS-mf—11092) **Determination of Commercial Karats on Gold Alloys for Jewellery.** Morales, S.E.A. (Seccion Industrial de la Direccion General de Energia Nuclear, Guatemala). (Direccion General de Energia Nuclear, Guatemala City (Guatemala)). Dec 1986. 9p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701315/JAW.

An XRF method for the gold content determination in gold alloys was proposed and tested. Gold coins and ingot samples were analyzed. Monoelemental standards and two pint regression curves calculated with the NBSGSC program, Cd-109 annular source, Si-Li detector, 4096 channels analyzer and AXIL deconvolution software were employed. Good precision better than 1.5% and accuracy better than 2% were obtained.

11967 (INIS-SU—431, pp 540) **Potentialities of nuclear-physical methods during investigation of optical materials.** Ter-Nersesyants, V.E. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11968 (INIS-SU—431, pp 550) **Use of /sup 9/Be (α, nγ) /sup 12/C reaction in nuclear microanalysis.** Chirt, V.K.; Skakun, N.A.; Storizhko, V.E.; Deev, A.S.; Olejnik, V.A.; Svetashov, P.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11969 (INIS-SU—431, pp 558) **Analysis of Nb, Ta and Ag in samples using X-ray spectroscopy of photonuclear reaction products.** Davydov, M.G.; Magera, V.G.; Danilovich, S.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11970 (INIS-SU—431, pp 592) **Possibilities of neutron radiation analysis with the use of fast neutrons for determination of elementary composition of rocks.** Guma, V.I.; Galyamin, S.N.; Demidov, A.M.; Miller, V.V.; Parnyakov, V.L. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11971 (INIS-SU—431, pp 596) **Analysis of composition of Uzbekistan drug plants.** Mukhammedov, S.; Badalov, N.B.; Tillyaeva, Kh.; Omonov, Sh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11972 (INIS-SU—431, pp 590) **X-ray fluorescence method of diffusion depth determination in thermodiffusion layers.** Didorenko, V.A.; Melikhov, V.D.; Pecherskij, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

11973 (ORNL/TM—10643) **Ion microprobe mass spectrometry using sputtering atomization and resonance ionization: Final report.** Goeringer, D.E.; Christie, W.H.; Bertram, L.K.; Walker, R.L.; Carter, J.A. (Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003688/JAW.

Resonance ionization mass spectrometry (RIMS) utilizing ion beam sputtering has been applied to the measurement of U. The goal is to produce an ultra-sensitive technique for analysis of small environmental particles. The method has also been compared with secondary ion mass spectrometry (SIMS). Samples studied were uranium metal, UO_3 (polycrystalline and single crystal), and U_3O_8. The overall efficiency of detection for sputter atomization/resonance ionization mass spectrometry (SA/RIMS), U^+ photoions counted/U atoms sputtered, was approximately 9×10^{-4}. Results in-

dicate that the density of ground-state U atoms sputtered from such samples is quite sensitive to oxygen content and surface contamination. The relative ratio of ground-state U atoms sputtered from U metal and UO_2 (U°/sub metal//U°/sub oxide/) with Ar^+ was estimated as 4.4 x 10^1. This relatively large matrix effect severely limits the applicability of SA/RIMS to quantitative analysis of uranium samples. 11 figs., 2 tabs.

11974 Mixed-ligand chelate extraction of lanthanides with 1-phenyl-3-methyl-4-(trifluoroacetyl)-5-pyrazolone and some phosphine oxide compounds. Umetani, S.; Freiser, H. (Univ. of Arizona, Tucson). *Inorganic Chemistry;* **26**: No. 19, 3179-3181(23 Sep 1987).

Mixed-ligand chelate extraction of lanthanides (Ln) such as La, Pr, Eu, Ho, and Yb into chloroform with 1-phenyl-3-methyl-4-(trifluoroacetyl)-5-pyrazolone (HPMTFP) and with one of three phosphine oxide compounds is studied. The phosphine oxide compounds employed in the present work are tri-n-octylphosphine oxide (TOPO), n-octylphenyl(N,N-diisobutylcarbamoylmethyl)phosphine oxide (CMPO), and methylenebis(diphenylphosphine oxide) (MBDPO). Lanthanide ions are found to be extracted from a 0.1 M sodium perchlorate medium as $Ln(PMTFP)_3(TOPO)_3$ and $Ln(PMTFP)_3(CMPO)$, respectively. In the extraction of lanthanides with the mixture of HPMTFP and MBDPO, the extracted species are found to be $Ln(PMTFP)_3(MBDPO)$ or $Ln(PMTFP)_2(ClO_4)(MBDPO)_3$ in the absence or presence of sodium perchlorate, respectively. The extraction constants of these systems do not increase monotonically with atomic number but have a maximum at Eu or Ho. 11 references, 4 tables.

11975 Isotopic ratio measurements with an inductively coupled plasma source mass spectrometer. Russ, G.P. III; Bazan, J.M. (Lawrence Livermore National Lab., CA, USA). *Spectrochimica Acta, Part B: Atomic Spectroscopy;* **42**: No. 1-2, 49-62(1987). (CONF-860101—).

From Winter conference on plasma spectrochemistry; Maui, HI, USA (3 Jan 1986).

An inductively coupled plasma source mass spectrometer has been used to measure the isotopic composition of U, Pb, Os and B standards. Factors which control accuracy and precision of isotopic ratios are discussed. After correction for dead time, background, and mass bias, the $^{238}U/^{235}U$ ratios for < 1μg ml^{-1} solutions agreed with the standard values within 0.5% for ratios ranging from unity to 200. For SRM 981 the $^{207}Pb/^{206}Pb$ and $^{204}Pb/^{206}Pb$ agreed with the standard values within 0.3% with precisions of approx. = + - 0.3%. Mass dependent variations, 1-2% amu^{-1}, of the observed ratios from the standard ratios were observed in all analyses. These deviations increased linearly with increasing mass difference and always favored the loss of the lighter isotopes from the measured beam. No variation in boron (1μg ml^{-1}) isotopic ratios was observed between a solution containing 40 μg ml^{-1} lead and a lead free solution. Osmium was introduced directly into the ICP which resulted in a factor of approx. 80 enhancement in signal over that obtained by nebulization. Osmium isotope ratios were measured with < 1% precision for < 5 ng of osmium.

11976 Elemental and isotopic analysis of powders by inductively coupled plasma mass spectrometry with arc nebulization. Shiuhjen Jiang; Houk, R.S. (Ames Lab., IA, USA; Iowa State Univ. of Science and Technology, Ames, USA. Dept. of Chemistry). *Spectrochimica Acta, Part B: Atomic Spectroscopy;* **42**: No. 1-2, 93-100(1987). (CONF-860101—).

From Winter conference on plasma spectrochemistry; Maui, HI, USA (3 Jan 1986).

A powdered sample is mixed with graphite and pressed into a conducting pellet. The pellet is eroded by an intermittent arc, and the resulting sample particles are injected into an inductively coupled plasma mass spectrometer (ICP-MS). This provides rapid survey analysis and determination of elemental and isotope ratios without dissolution of the sample. Small peaks for ArC^+, ArO^+, and Ar_2^+ are the only species detected in the background spectrum above m/z 45. The absence of nebulized water effectively suppresses formation of metal oxide ions. Detection limits are 30-50 μg g^{-1} for the elements studied. Isotopic ratios may be determined with a precision of approximately 1% relative standard deviation for major constituents. Various rare earth elements are determined quantitatively at 0.1-1% levels in the original sample.

11977 Characterization of selected nuclear fuel cycle materials by column extraction chromatography and ICP-AES. Huff, E.A. (Argonne National Lab., IL, USA). *Spectrochimica Acta, Part B: Atomic Spectroscopy;* **42**: No. 1-2, 275-283(1987). (CONF-860101—). Contract W-31-109-ENG-38.

From Winter conference on plasma spectrochemistry; Maui, HI, USA (3 Jan 1986).

Current research efforts at the Argonne National Laboratory on nuclear reactor fuel developments require analytical support for the characterization of uranium metal and uranium-bearing alloys and salts. Attempts to determine trace elements at the μg g^{-1} level in these matrices directly by inductively coupled plasma-atomic emission spectrometry (ICP-AES) proved unsuccessful. Even at moderate uranium concentrations (500 μg ml^{-1}), severe spectral interferences for a large number of elements were observed. As a consequence, methods were developed that allowed the quantitative separation of 35 impurities from uranium prior to ICP-AES analysis. Column extraction chromatography was used with neutral organophosphorus compounds as extractants. Uranium was adsorbed by the organic phase and the impurities were eluted by nitric acid. After evaporation and volume adjustment, the trace metals were determined by ICP-AES. Except for Sc and Zr, recoveries obtained using this technique were 86-107%.

11978 Boron isotopic composition of marine and nonmarine evaporite borates. Swihart, G.H.; Moore, P.B.; Callis, E.L. (Chicago Univ., IL, USA. Dept. of Geophysical Sciences; Argonne National Lab., IL, USA). *Geochimica et Cosmochimica Acta;* **50**: No. 6, 1297-1301(Jun 1986).

Here we present the results of the boron isotopic analysis of borates from some well-known marine and nonmarine evaporite deposits. Combining new analyses with analyses from the literature yields a mean delta^{11}B value for nine marine evaporite borate analyses of 25 +- 4 permil ($^{11}B/^{10}B$ = 4.15 +- 0.02) and a mean for twenty-five nonmarine evaporite borates of -7 +- 10 permil ($^{11}B/^{10}B$ = 4.02 +- 0.04). Previous studies have shown that the boron isotopic composition of seawater (delta^{11}B approx. 40 permil, $^{11}B/^{10}B$ approx. 4.20) is about four percent heavier than the boron isotopic composition of most crustal rocks and minerals. We suggest that our results for marine and nonmarine evaporite borates reflect this difference. Thus it should be possible to use boron isotopic composition as a tracer for boron of marine evaporitic origin. Applications include borate-bearing evaporite deposits and, perhaps, borate and/or borosilicate-bearing metamorphic rocks.

11979 Quantitative passive technique for assay of near-surface tritium in materials. Pregenzer, A.L.; Kertst, R.A. (Sandia National Labs., Albuquerque, NM, USA; Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* **92**: No. 1-4, 249-252(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A quantitative passive technique for the assay of near-surface tritium in materials is described. The method uses a channel electron multiplier (CEM) and Monte Carlo calculations of the energy-angle escape distributions for beta electrons. Comparisons between the experimental and calculated values of the CEM count rate are presented. (U.K.).

11980 Analytical atomic spectroscopy of plutonium. 1. High resolution spectra of plutonium emitted in an inductively coupled plasma. Edelson, M.C.; DeKalb, E.L.; Winge, R.K.; Fassel, V.A. (Ames Lab., IA, USA). *Spectrochimica Acta, Part B: Atomic Spectroscopy;* **41B**: No. 5, 475-486(1986).

Presented in part at 12. annual FACSS meeting, Philadelphia, 29 September-4 October 1985.

In the atomic emission spectrum of Pu-242 emitted in an inductively coupled plasma (ICP) 23 lines with detection limits of less than 100 ng/ml were identified in the 200-700 nm spectral range. The line at 453.614 nm had the best detection limit of 15 ng/ml. The isotopic splittings of several Pu emission lines were resolved with a commercial 1.5 m spectrometer. The line at 398.988 nm (Pu-240 wavelength) had the greatest isotope shift, but was interfered

with by neighboring Pu lines. Other lines were shown to be useful for Pu isotopic analysis. The hyperfine splitting of some intense Pu-239 lines was measured; the Pu 453.614 nm line exhibited the widest splitting (5.9 pm).

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REFER ALSO TO CITATION(S) 10720, 10730, 10731, 10734, 10789, 10924, 11077, 11177, 11398, 11834, 12027, 12028, 12536, 12548, 13709

11981 (AD-A—185162/5/XAB) Methanol decomposition on Ni(111): investigation of the C-O bond-scission mechanism. Russell, J.N.; Chorkendorff, I.; Yates, J.T. (Pittsburgh Univ., PA (USA). Surface Science Center). 1987. 9p. NTIS, PC A02/MF A01.

Pub. in Surface Science, Vol. 183, 316-330(1987).

The possibility of a C-O bond-scission mechanism in the decomposition of CH_3OH on Ni was examined by mole-fraction analysis of the desorbing CO isotopes produced by the decomposition of an adsorbed mixture of $^{13}CH^{16}O$ and $^{13}CH_3{}^{18}OH$ on a Ni(111) surface. No isotopic scrambling was observed on the clean, H-precovered, or sputter roughened Ni(111) surfaces. However, isotopic scrambling could be induced in the desorbing CO by Ar^+ sputtering the adsorbed mixture of methanol isotopes. Whether the C-O bond scission mechanism could be methanol-flux dependent was also explored. Carbon deposition at trace levels, a proposed consequence of C-O bond scission, was observed for high methanol fluxes (F>1X1016/2 sq cm s). However, the small amount of carbon deposited was exposure rather than flux dependent and was due to low impurity levels in the methanol. C-O bond scission for methanol on Ni(111) is not a viable elementary process under any of the methanol-flux conditions explored, and that its maximum efficiency at 180 K is <.0002/CH_3OH collision. When Ni(111) crystal is heated in a molecular beam of methanol (F > or = 2 X 10 13 sq cm/sq cm-2s), two H_2 desorption features are observed. Low-temperature feature (370 K) results from desorption-limited H_2 desorption and corresponds to the beta 2-H_2 desorption feature from H/Ni. High-temperature features (430 K) can be explained by accelerated methanol surface reactivity during exposure to methanol after blocked surface sites open by thermal desorption of CO.

11982 (BARC—1354) Thermodynamic and transport properties of heavy water : formulations and results. Ghosh, S.K.; Dave, S.M.; Sadhukhan, H.K. (Bhabha Atomic Research Centre, Bombay, India. Heavy Water Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 119p. NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701239/JAW.

This report summarises the best formulations for the properties of heavy water substance for the entire desired range. The numerical values of various properties of pure D/sub 2/O over the complete range of temperature (3.80 - 800degC) and pressure (0.01 - 100 MPa) are compiled. The properties corresponding to the state of saturation are presented as functions of both temperature and pressure. 26 refs.

11983 (BARC—1364) Ion exchange resins for water purification : properties and characterisation. Gokhale, A.S.; Mathur, P.K.; Venkateswarlu, K.S. (Bhabha Atomic Research Centre, Bombay, India. Water Chemistry Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701246/JAW.

The report is divided into three sections. The first section contains a general introduction to ion exchange resins used in various processes, the second section describes characteristic properties of the polymer materials and the inter relation between them. This will, in turn, be useful to interpret the data obtained from the various tests carried out on the resins in the laboratory. In the third section of the report, are given the details of each method used for a particular test to be carried out on a routine basis. Each method describes the principle involved, the reagents and apparatus used in the experiment, the actual procedure and calculations and recording of the data. 3 refs.

11984 (CONF-870825—3) Anisotropic hyperfine interactions and spin relaxation in neptunyl salts. Asch, L.; Dunlap, B.D.; Marquardt, R.; Potzel, W.; Litterst, F.J.; Werner, G.D.; Weigel, F.; Spirlet, J.C.; Kalvius, G.M. (Muenchen Univ. (Germany, F.R.). Sektion Physik; Argonne National Lab., IL (USA); Muenchen Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie; Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). Sep 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003103/JAW.

From International conference on the applications of the Moessbauer effect; Melbourne, Australia (17 Aug 1987).

Moessbauer spectra of hexavalent neptunyls $X_3(NpO_2)Cl_4$ and $X_4(NpO_2)(CO_3)_3$ with X = Na, K, Cs, (NH_4) and $[(C_2H_5)_4N]$ are discussed and compared to EPR data. In cases where reliable values of hyperfine parameters can be extracted, the Moessbauer spectra give fine details of bonding structure. It is found that the O-Np-O bond is not linear and that exchanging the cation results in small but definite changes. 9 refs., 5 figs.

11985 (CONF-8706187—, pp 13-18) Electron attachment phenomena in heated plasmas. Chutjian, A.; Alajajian, S.H.; Orient, O.J. (California Institute of Technology, Pasadena). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Recent JPL experimental and theoretical results of electron attachment to molecules at ultralow energies are discussed. Specifically, electron attachment to F_2, and temperature dependencies of attachment rate constants in $CFCl_3$ and CCl_4 are used to illustrate some interesting features. Extensions to several important areas involving plasma-surface interactions are outlined.

11986 (CONF-8706187—, pp 52-60) Physicochemical applications of supercritical fluid chromatography. Bruno, T.J. (National Bureau of Standards, Boulder, CO). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Supercritical fluid chromatography is a technique which offers many unique advantages and opportunities when implemented as a physicochemical measurement tool. A logical intermediary between gas chromatography (G.C.) and high performance liquid chromatography (H.P.L.C.), supercritical fluid chromatography (S.F.C.) finds a natural place in thermophysics research. A brief overview of S.F.C is given (with reference to a newly constructed instrument), followed by a general description of the measurements made possible by this instrument. In addition, some preliminary measurements are presented.

11987 (CONF-8706187—, pp 61-68) High temperature thermal conductivity apparatus for fluids. Roder, H.M. (National Bureau of Standards, Boulder, CO). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A new apparatus for measuring both thermal conductivity and thermal diffusivity of fluids at high temperatures is described. The technique employed is that of the transient hot wire. Measurements are made with a 12.7 μm diameter platinum wire at times of up to 1 second. The data acquisition system is controlled by a microcomputer and includes several programmable digital voltmeters. The hot wire and a shorter compensating hot wire are arranged in different arms of a Wheatstone bridge. The cell containing the core of the apparatus is designed to accommodate pressures from near zero to 70 MPa and temperatures from 0 to 500°C. For thermal conductivity, the precision of the new system is expected to be around 0.3% and the accuracy 1.0%. For thermal diffusivity the accuracy is estimated to be around 5%. From the two variables measured, one can obtain values of the specific heat, C/sub p/, of the fluid, provided that the density is either measured, or available through an equation of state.

11988 **(CONF-8709113—3) Insights into the mechanisms on chemical reactions: reaction paths for chemical reactions.** Dunning, T.H. Jr.; Rosen, E.; Eades, R.A. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003041/JAW.

From Faraday discussion on dynamics of elementary gas phase reactions; Birmingham, UK (14 Sep 1987).

We report reaction paths for two prototypical chemical reactions: Li + HF, an electron transfer reaction, and OH + H_2, an abstraction reaction. In the first reaction we consider the connection between the energetic terms in the reaction path Hamiltonian and the electronic changes which occur upon reaction. In the second reaction we consider the treatment of vibrational effects in chemical reactions in the reaction path formalism. 30 refs., 9 figs.

11989 **(CONF-8710214—2) Max Bredig Award acceptance speech: Creating a crystal ball for molten salt solutions.** Blander, M. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002870/JAW.

From International symposium on molten salts; Honolulu, HI, USA (18 Oct 1987).

Molten salts are relatively simple as a solvent and should be relatively simple to model theoretically. Concepts and theories developed to describe molten salts should provide the means for making predictions beyond the scope of the information used to deduce them. This paper describes the development of a "crystal ball" to predict future experiments and properties of molten salts. 26 refs., 3 figs. (CS)

11990 **(DOE/ER/13678—8) Thermodynamic studies of the solubilization of organic compounds by aqueous surfactant systems.** Smith, G.A. (Oklahoma Univ., Norman (USA)). 1986. Contract FG05-87ER13678. 261p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88003360/JAW.

A detailed thermodynamic study of the solubilization of organic compounds in aqueous surfactant solutions has been performed. Precise values of the activities of both solubilized organic solute and surfactant have been determined using the solute pressure method and the semi-equilibrium dialysis method. The SED method is perfectly general so long as there exists an analytical method for determining the concentration of the organic solute in the permeate solutions. The precision of the results obtained using the SED method is surpassed only by vapor pressure measurements. 55 refs., 55 figs., 73 tabs.

11991 (INIS-SU—430, pp 33) **Polycenter coordination on surface and in solutions as chemical activation source in catalysis.** Bersuker, I.B. (AN Moldavskoj SSR, Kishinev. Inst. Khimii). 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11992 (INIS-SU—430, pp 90) **Synthesis, characterization and catalytic properties of ruthenium carbonyl clusters, containing iron and platinum.** Gopinathan, S.; Joseph, K.; Unny, I.R.; Hundekar, A.M.; Gopinathan, C. (National Chemical Lab., Poona, India). 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11993 (INIS-SU—430, pp 138) **Complex formation of transition metal complexing with homogeneous and heterogenized carboxylate ligands.** Kudryavtsev, G.V.; Mil'chenko, D.V.; Lisichkin, G.V. (Moskovskij Gosudarstvennyj Univ., USSR). 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11994 (INIS-SU—430, pp 142) **Comparison of properties of phosphomolybdenum heteropolyacid homogeneous and heterogeneous catalysts.** Kutyrev, M.Yu.; Margolis, L.Ya.; Staroverova, I.N.; Krylov, O.V. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11995 (INIS-SU—430, pp 181) **Study on interaction of surface alkyl and hydride compounds of Ti, Zr and Hf with carbon monoxide.** Nesterov, G.A.; Zakharov, V.A.; Vasnetsov, S.A.; Paukshtis, E.A. 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11996 (INIS-SU—430, pp 186) **Surface organometallic chemistry and catalysis by grafted clusters: Os/sub 3/(CO)/sub 12/ and Ru/sub 3/(CO)/sub 12/ supported by silica.** D'Ornelas, L.D.; Theolier, A.; Choplin, A.; Basset, J.M. 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11997 (INIS-SU—430, pp 195) **Molecular catalysts, immobilized in pillared clays.** Pinnavaia, Th.J.; Rightor, E.G.; Giannelis, E.P. (Michigan Univ., Ann Arbor, USA). 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11998 (INIS-SU—430, pp 190) **Clusters on the basis of gold alloys with transition metals.** Pin'ole, L.Kh. (Minnesota Univ., Minneapolis, USA). 1986. (In Russian). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

11999 (INIS-SU—430, pp 214) **Role of surface oxygen complexes and CO in its oxidation on Pd-containing supported catalysts.** Savel'va, G.A.; Popova, N.M.; Shvets, V.A.; Kazanskij, V.B. (AN Kazakhskoj SSR, Alma-Ata. Inst. Metallurgii i Obogashcheniya; AN SSSR, Moscow. Inst. Organicheskoj Khimii). 1986. (In Russian). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

12000 (INIS-SU—430) **5. International symposium on interrelation between homogeneous and heterogeneous catalysis. Summaries of reports.** (AN SSSR, Moscow. Nauchnyj Sovet po Katalizu; AN SSSR, Novosibirsk. Inst. Kataliza). 1986. vp. (In Russian). (CONF-8607351—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW.

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

Individual items are processed separately for the data base. (DLC)

12001 **(INIS-SU—430) 5. International symposium on relations between homogeneous and heterogeneous catalysis. Abstracts.** (AN SSSR, Moscow. Nauchnyj Sovet po Kataliz; AN SSSR, Novosibirsk. Inst. Kataliza). 1986. 356p. (CONF-8607351—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW.

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

Individual papers within the scope of atomindex were indexed separately.

12002 **(N—88-10191) Synthesis and characterization of processable polyimides with enhanced thermal stability. Final report, 1 March 1986-28 February 1987.** Harris, F.W. (Akron Univ., OH (USA)). Oct 1987. 26p. (NASA-CR—181447; NAS—1.26:181447). NTIS, PC A03/MF A01.

Many of the emerging applications of polymers on space vehicles require materials with outstanding thermal stability. These polymers must also be readily processable in order to facilitate their use. The syntheses and polymerization of a cardo dianhydride were investigated. This monomer was prepared via the reaction of N-methyl 4-nitrophthalimide with a cardo diol. Polyimides containing oxyalkylene linkages were studied. The effects of two additional structural modifications on the polymers' properties were investigated. The effects of carrying out the preparation of poly(amic acid)s under non-equilibrium conditions were examined. Approaches that were investigated included the in-situ neutralization of the generated amic acid and its in-situ esterification.

12003 **(PB—88-102918/XAB) Volatile organic compounds in whole blood - determination by heated dynamic headspace purge and trap isotope-dilution GC/MS. Special report, November 1984-August 1987.** Cramer, P.H.; Boggess, K.E.; Hosenfeld, J.M. (Midwest Research Inst., Kansas City, MO (USA)). Jul 1987. 46p. NTIS, PC A03/MF A01.

The method described was developed for the determination of a selected list of 30 organic compounds in whole human blood. The method is a heated dynamic head-space purge and trap gas chromatographic method using mass spectrometry in the limited mass-scan mode. A whole blood sample is diluted with organic free water and the mixture fortified with isotopically labeled compounds. The mixture is subsequently heated to 50°C while stirred, and the volatile components are purged from the mixture and collected on an adsorbent trap. The volatile compounds are thermally desorbed from the trap onto a wide-bore fused-silica capillary column. Detection of the compounds is accomplished using mass spectrometry in the limited mass-scan mode where only selected ions are scanned. Quantitation of the analytes is accomplished by using the specific ion responses from standards of the analytes and their corresponding labeled analogs or internal standards.

12004 **(UCID—21239) High-temperature reaction rates for five- and six-carbon saturated alkanes.** Tamura, T.M. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004373/JAW.

High-temperature reaction rates for five- and six-carbon saturated alkanes were estimated for use in combustion modelling. The isomers investigated included n-hexane, 2-methylbutane, 2-methylpentane, 3-methylpentane, 2,2-dimethylpropane, 2,2-dimethylbutane, and 2,3-dimethylbutane. A total of 43 new species and 446 reactions were added to the existing data file (CDAT). 19 refs.

12005 **Vibrational energy relaxation processes in heme proteins: model systems of vibrational energy dispersion in disordered systems.** Genberg, L.; Heisel, F.; McLendon, G.; Miller, R.J.D. (Univ. of Rochester, NY). *Journal of Physical Chemistry;* **91**: No. 22, 5521-5524(22 Oct 1987).

Vibrational energy relaxation pathways from optically excited heme proteins are studied by using a transient thermal phase grating technique which monitors the solvent lattice temperature. Vibrational energy transfer from the porphyrin ring to the protein backbone leads to extensive delocalization of the energy in the protein matrix which is efficiently transferred to the water interface in less than 20 ps. A slower relaxation process on the nanosecond time scale is also observed. The slow relaxation component is attributed to slow conformational relaxation processes of high potential energy states of the heme proteins accessed during the high internal energy conditions of the optically excited molecule.

12006 **Hole burning spectroscopy of a core antenna complex.** Gillie, J.K.; Hayes, J.M.; Small, G.J.; Golbeck, J.H. (Iowa State Univ., Ames). *Journal of Physical Chemistry;* **91**: No. 22, 5524-5527(22 Oct 1987). Contract W-7405-ENG-82.

Zero-phonon, vibronic, and phononic satellite hole structure are reported for a core antenna complex (C670) of photosystem I. The electron-protein phonon coupling of C670 is compared with that for the primary electron donor state P700. Low-frequency phonons ($\sim$ 30 cm^{-1}) are implicated as the primary acceptor modes for excitation transport from the antenna to the reaction center. Excitation transport within the antenna at helium temperatures is markedly slower than at room temperature.

12007 **Infrared bands of acetone in solid argon and the structure II clathrate 2acetylene/acetone/17water.** Consani, K. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **91**: No. 22, 5586-5588(22 Oct 1987). Contract AC03-76SF00098.

The vibrational bands of acetone in solid argon and in the structure II 2acetylene/acetone/17water clathrates are presented. The results show that the band frequencies for enclathrated acetone are not greatly different from the unperturbed acetone frequencies. The acetone does not rotate on the IR time scale, and little evidence for site effects was observed (except for possibly lifting the degeneracy of an antisymmetric stretch of CH_3). Both of the C-C stretches of acetone undergo small blue shifts, though the reason is unclear.

12008 **In situ fourier transform infrared study of crotyl alcohol, maleic acid, crotonic acid, and maleic anhydride oxidation on a V-P-O industrial catalyst.** Wenig, R.W.; Schrader, G.L. (Iowa State Univ., Ames). *Journal of Physical Chemistry;* **91**: No. 22, 5674-5680(22 Oct 1987). Contract W-7405-ENG-82.

Crotyl alcohol, maleic acid, crotonic (2-butenoic) acid, and maleic anhydride were fed to an in situ infrared cell at 300°C containing a P/V = 1.1 vanadium-phosphorous-oxide (V-P-O) catalyst used for the selective oxidation of n-butane. Crotyl alcohol was used as a mechanistic probe for the formation of reactive olefin species observed during previous n-butane and 1-butene studies. Crotonic acid, maleic acid, and maleic anhydride were fed as probes for the existence of other possible adsorbed intermediates. Olefin species and maleic acid are proposed as possible reaction intermediates in n-butane selective oxidation to maleic anhydride. The involvement of peroxide species in the oxidation of butadiene to maleic acid is also discussed.

12009 **Chemisorption and surface reactions of D_2 and hydrocarbons on the Re(0001) single-crystal surface clean and in the presence of coadsorbed sulfur or carbon.** Kelly, D.G.; Odriozola, J.A.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **91**: No. 22, 5695-5705(22 Oct 1987). Contract AC03-76SF00098.

The chemisorption and surface reactions of thiophene, D_2, and the hydrodesulfurization products (1,3-butadiene and butenes) have been studied on Re(0001) at low ambient pressure (10^{-9} Torr) by using thermal desorption spectroscopy (TDS), low energy electron diffraction (LEED), and Auger electron spectroscopy (AES). D_2 adsorption was found to be blocked by sulfur or carbon overlayers. Sulfur preadsorption induced small changes in the D_2 desorption energy, and adsorption was completely blocked above 0.4 monolayer of sulfur (theta/sub s/ = 0.4). Carbon preadsorption lowered the temperature of the desorption maxima (380 to 290 K), and blocked D_2 adsorption nonlinearly. Sequential dehydrogenation of the adsorbed unsaturated hydrocarbons leading to complete decomposition at high temperatures (> 700 K) was observed on the clean Re(0001) surface. Addition of sulfur or carbon blocked dehy-

drogenation. No changes in the dehydrogenation (yielding H_2) TDS peak temperatures were observed for either sulfur or carbon preadsorption. However, selective blocking of dehydrogenation states was observed for both sulfur and carbon preadsorption. In addition, carbon adsorption did allow hydrogenation of butadiene to occur. It is concluded that for all systems preadsorbed sulfur acts as a site blocker for adsorption and dissociation with only small effects on bonding of adsorbed molecules on Re(0001). Although this also seems to be true for preadsorbed carbon as well, other subtle effects are observed that can change the surface chemistry of adsorbed molecules, as exemplified by the hydrogenation of butadiene.

12010 **Oxidation of ruthenium(II) ammine complexes by 1-hydroxy-1-methylethyl radicals and by tris(bipyridyl)cobalt(III) ions.** Bakac, A.; Butkovic, V.; Espenson, J.H.; Marcec, R.; Orhanovic, M. (Rudjer Boskovic Institute, Zagreb, Yugoslavia). *Inorganic Chemistry;* **26**: No. 20, 3249-3253(7 Oct 1987). Contract W-7405-ENG-82.

The kinetics of oxidation of $Ru(NH_3)_5^{2+}$ and of $(NH_3)_5Ru(NC_5H_4X)^{2+}$, X = H, 3-Cl, 4-$CH_3$, 4-$C(CH_3)_3$, and 4-$N(CH_3)_2$, by /sup ./$C(CH_3)_2OH$ (k/sub R/) and by $Co(bpy)_3^{3+}$ (k/sub Co/) have been evaluated. Values of log k/sub R/ vary linearly with log k/sub Co. The individual values of log k/sub R/ and log k/sub Co/ are both correlated by the Hammett σ parameters, the reaction constants being rho = -0.50 +/- 0.03 and -1.9 +/- 0.1, respectively. The reactions of all the Ru(II) complexes with /sup ./$C(CH_3)_2OH$ are acid-catalyzed (k/sub R/ = k/sub R0/ + k/sub R1/$[H^+]$), an unprecedented observation. This suggests the rate-limiting step is solvolysis of an ion-paired successor complex, $[RuL_6^{3+},^-C(CH_3)_2OH]$, with H_2O and H_3O^+ each being solvolytically active. 30 references, 4 figures, 4 tables.

12011 **Synthesis and characterization of monometallic and bimetallic mixed-ligand complexes of iron(II) containing 2,2'-bipyrimidine or 2,3-bis(2-pyridyl)pyrazine.** Brewer, K.J.; Murphy, W.R. Jr.; Petersen, J.D. (Clemson Univ., SC). *Inorganic Chemistry;* **26**: No. 20, 3376-3379(7 Oct 1987). Contract AS09-80ER10671.

Mono- and bimetallic complexes of the form $Fe(CN)_4BL^{2-}$ and $[Fe(CN)_4]_2(BL)^{4-}$, where BL = 2,2'-bipyrimidine (bpm) or 2,3-bis(2-pyridyl)pyrazine (dpp), have been prepared and characterized by column chromatography, uv-visible spectroscopy, cyclic voltammetry, and coulometry. The complexes are stable in aqueous solution and have electronic spectra dominated by intense metal-to-ligand charge-transfer (MLCT) transitions in the visible region of the spectrum. The maximum for the lowest energy MLCT peak in the monometallic complexes is in the 530-550-nm region while the bimetallic complexes, with an increased stability of the π^* orbitals on BL, show maxima in the 580-660-nm region. The monometallic complexes display one reversible oxidation corresponding to the Fe(III/II) couple, while two reversible oxidations, separated by 140-150 mV, are observed for the bimetallic complexes. 34 references, 2 figures, 2 tables.

12012 **Bromine oxidation of a nickel(II) bis(oxime-imine) complex. Evidence for a single-step outer-sphere two-electron transfer?.** Lappin, A.G.; Osvath, P.; Baral, S. (Univ. of Notre Dame, IN). *Inorganic Chemistry;* **26**: No. 19, 3089-3094(23 Sep 1987).

The kinetics and mechanism of the two-electron oxidation of the sexidentate bis(oxime-imine) complex of nickel(II), [Ni/sup II/L] (I), by bromine have been investigated in bromide ion media over the pH range 3.1-7.6 at 25°C and 1.0 M ionic strength. In the presence of an excess of bromine or nickel(II), oxidation is monophasic, and the initial product is $[Ni/sup IV/L]^{2+}$, a formal nickel(IV) species that undergoes subsequent reactions to give an unknown oxidation product with excess bromine at pH > 6 or to give $[Ni/sup III/L]^+$ by comproportionation with excess nickel(II) at pH > 5. The sole kinetically important oxidant is Br_2, and second-order rate constants for reaction of [Ni/sup II/L] and its protonated form $[Ni/sup II/LH]^+$ are 2.1 x 10^7 and 7.1 x 10^5 M^{-1} s^{-1}, respectively. These rate constants are in line with a rate-determining single-electron-transfer reaction, and the proposed mechanism involves formation of a transient ion pair $[Ni/sup III/L^+,Br_2^-]$ in which the rate of subsequent electron transfer is comparable with the rate of ion-pair dissociation. In addition, the pulse-radiolysis technique has been used to investigate the reactions of nickel(II) with Br_2^- to give $[Ni/sup III/L]^+$, and rate constants for [Ni/sup II/L] and $[Ni/sup II/LH]^+$ are 8.5 x 10^8 and 2.7 x 10^8 M^{-1} S^{-1}, respectively, at 21°C. 34 references, 3 figures, 3 tables.

12013 **Ligand design for enhanced stereoselectivity in the electron-transfer reactions between nickel(IV) bis(oxime-imine) complexes and $[Co(edta)]^{2-}$.** Martone, D.P.; Osvath, P.; Lappin, A.G. (Univ. of Notre Dame, IN). *Inorganic Chemistry;* **26**: No. 19, 3094-3100(23 Sep 1987).

A number of derivatives of the sexidentate bis(oxime-imine) ligand 3,14-dimethyl-4,7,10,13-tetraazahexadeca-3,13-diene-2,15-dione dioxime, $Me_2L(1)H_2$, have been prepared in which the methyl groups on the oxime-imine chromophores are replaced by more bulky phenyl groups, $MePhL(1)H_2$ and $PhMeL(1)H_2$, or chiral (S) methyl (L(2)) and benzyl (L(3)) groups are attached on the amine backbone at the 5- and 12-positions. Nickel(II) complexes of the ligands can be oxidized to the corresponding nickel(III) and nickel(IV) derivatives, and the effect of changing ligand structure on the reduction potentials of the complexes is small. Self-exchange rate constants for the nickel(IV)/nickel(III) change have been estimated from the rates of the cross-reactions between [Ni/sup III/MePhL(1)]$^+$ and [Ni/sup III/PhMeL(1)]$^+$ and their chiral (5S, 12S)-dimethyl nickel(IV) derivatives to be 8 x 10^5 and 4 x 10^6 M^{-1} s^{-1}, respectively, at 25°C and 0.1 M ionic strength. The kinetics and mechanisms of reduction of [Ni/sup IV/MePhL(1)]$^{2+}$ and [Ni/sup IV/PhMeL(1)]$^{2+}$ and $[Co(edta)]^{2-}$ have also been investigated. Stereoselectivity in the oxidation of $[Co(edta)]^{2-}$ by nickel(IV) has been investigated by using these chiral complexes, and in all cases the preferred isomer of the product $[Co(edta)]^-$ is Δ with enantiomeric excesses of 7%, 21%, 22%, and 46% for the complexes [Ni/sup IV/PhMeL(2)]$^{2+}$, [Nk/sup IV/MePhL(2)]$^{2+}$, [Ni/sup IV/$Me_2L(3)$]$^{2+}$, and [Ni/sup IV/MePhL(3)]$^{2+}$, respectively. 32 references, 5 figures, 4 tables.

12014 **Technetium electrochemistry. 4. Electrochemical and spectroelectrochemical studies on the bis(tertiary phosphine or arsine (D))rhenium(III) complexes trans-$[ReD_2X_2]^+$ (X = Cl, Br). Comparison with the technetium(III) analogues.** Kirchhoff, J.R.; Heineman, W.R.; Deutsch, E. (Univ. of Cincinnati, OH). *Inorganic Chemistry;* **26**: No. 19, 3108-3113(23 Sep 1987). Contract AC02-80EV10380.

The redox properties of a series of rhenium(III) complexes with the general formula trans-$[ReD_2X_2]^+$ (where D is one of the chelating phosphine or arsine ligands 1,2-bis(dimethylphosphino)ethane, 1,2-bis(diethylphosphino)ethane, 1,2-bis(diphenylphosphino)ethane, or 1,2-bis(dimethylarsino)benzene and X is Cl or Br) were investigated in 0.5 M TEAP/DMF by cyclic voltammetry, thin-layer electrochemistry, and thin-layer spectroelectrochemistry. The cationic trans-$[ReD_2X_2]^+$ complexes exhibit a diffusion-controlled, reversible one-electron reduction to the neutral trans-$[ReD_2X_2]^0$ complexes at a platinum-disk electrode. The formal reduction potential, $E^{0'}$, of the Re(III/II) redox couple ranges from -0.205 to 0.450 V vs Ag/AgCl (3 M NaCl). Further reduction to the rhenium(I) anion, trans-$[ReD_2X_2]^-$, is possible; however, the reversibility of this process depends on the nature of the coordinating ligands and the experimental conditions. The Re(II/I) redox couple occurs at an $E^{0'}$ value ca. 1.11 V more negative than that of the corresponding Re(III/II) couple. Thin-layer spectroelectrochemistry has been used to study the halogen-to-metal charge-transfer (HTMCT) band(s) of the Re(III) and Re(II) complexes. 36 references, 7 figures, 3 tables.

12015 **Preparation and characterization of $NaW_2Cl_7(THF)_5$. A Synthetically useful precursor for X_3W identical with WX_6 compounds where X = CH_2-t-Bu, NMe_2, and O-t-Bu.** Chisholm, M.H.; Eichhorn, B.W.; Folting, K.; Huffman, J.C.; Ontiveros, C.D.; Streib, W.E.; Van Der Sluys, W.G. (Indiana Univ., Bloomington). *Inorganic Chemistry;* **26**: No. 19, 3182-3186(23 Sep 1987).

From the addition of Na/Hg (1 equiv) to a WCl_6 slurry in THF (THF = tetrahydrofuran) was obtained the green crystalline compound $NaW_2Cl_7(THF)_5$ in 60-70% recrystallized yields. The compound has been shown to involve a confacial bioctahedral

$W_2Cl_7(THF)_3^-$ anion coordinated to a $(THF)_3Na^+$ cation via two chloride ligands that are terminally bonded to W atoms. The W-W distance 2.4028 (15) A is essentially identical with that seen in other $W_2X_9^{3-}$ anions (X = Cl or Br) and is indicative of strong t/sub 2g/ ^{3}-t/sub 2g/^{3} M-M bonding. The compound provides a useful synthetic starting material for metathetic reactions involving Li-X leading to the known X_3W identical with WX_3 compounds where X = CH_2-t-Bu, NMe_2, and O-t-Bu. The latter are obtained in 60-80% yield based on W by either sublimation or crystallization. The compound $NaW_2Cl_7(THF)_3$ bears a striking similarity in terms of both its preparation and its reactivity to the compound formulated as $W_2Cl_5(THF)_4$ by Schrock, Sturgeoff, and Sharp, though it is not presently known how the two are related. Crystal data for $NaW_2Cl_7(THF)_3$ at -151°C: a = 18.817 (7) A, b = 8.397 (3) A, c = 20.964 (10) A, β = 107.09 (3)°, Z = 4, V = 3166.2 (1) A^3, d/sub calcd/ = 2.097 g cm^{-3}, space group $P2_1/c$. 20 references, 4 figures, 6 tables.

12016 **Effect of ligand geometry on ^{59}Co NMR relaxation in hexakis(phosphite)cobalt(III) complexes.** Socol, S.M.; Lacelle, S.; Verkade, J.G. (Iowa State Univ., Ames). *Inorganic Chemistry;* **26**: No. 19, 3221-3224(23 Sep 1987). Contract W-7405-ENG-82.

Previously reported results for the ^{59}Co - ^{31}P spin - spin couplings observed in the ^{59}Co NMR spectra of octahedral cobalt (III) complexes have suggested that the geometry of the ligands influences the relaxation of the ^{59}Co nucleus. The results of some measurements of the longitudinal relaxation of several of these complexes are reported. It is shown that the relaxation time of ^{59}Co in phosphite ester complexes of the type $Co(L_6)^{3+}$ decreases with a reduction in the symmetry of the ligands. The features of the ^{31}P NMR spectra for these complexes were due to the magnitudes and fluctuation times of the cobalt electric field gradients and the ^{59}Co - ^{31}P spin - spin couplings with an enlargement of the exocyclic group in a monocyclic phosphite ligand resulting in a decrease in the ^{59}Co - ^{31}P spin - spin coupling constants. 33 references, 4 figures, 2 tables.

12017 **Ambient-temperature superconductor symetrical metal-dihalide bis-(ethylenedithio)-tetrathiafulvalene compounds.** Williams, J.M.; Wang, H.H.; Beno, M.A. (to Dept. of Energy, Washington, DC). US Patent 4,675,415. 22 Sep 1987. Filed date 29 May 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a new class of organic superconductors having the formula (ET)/sub 2/MX/sub 2/ wherein ET represents bis(ethylenedithio)-tetrathiafulvalene, M is a metal such as Au, Ag, In, Tl, Rb, Pd and the like and X is a halide. The superconductor (ET)/sub 2/AuI/sub 2/ exhibits a transition temperature of 5 K which is high for organic superconductors.

12018 **Controlled microcrystalline growth studies by dynamic laser-light-scattering methods.** Byers, C.H.; Harris, M.T.; Williams, D.F. (Chemical Technology Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Industrial and Engineering Chemistry Research;* **26**: No. 9, 1916-1923(Sep 1987). Contract AC05-84OR21400.

A method for studying the dynamics of crystallization by using an in situ crystallizer in a dynamic laser-light-scattering system has been developed at the Oak Ridge National Laboratory. Results for growing systems in the size range 0.005-1 μm may be monitored nondestructively with this method. In a series of current tests, homogeneous precipitation techniques provided reproducible, controlled nucleation and growth of oxides such as hematite and silica. The hydrolysis of tetraethoxysilicate in ethyl alcohol, n-butyl alcohol, and tert-butyl alcohol was investigated as a function of initial water and ammonia concentrations. Ethyl alcohol concentration, particle size, and number concentration were studied as a function of time. In the presence of excess water, the growth rate of silica particles was found to have a first-order dependence on tetraethoxysilane concentration.

12019 **Reaction dynamics of electronically excited alkali atoms with simple molecules.** Weiss, P.S.; Mestdagh, J.; Schmidt, H.; Vernon, M.F. Covinsky, M.H.; Balko, B.A.; Lee, Y.T. (Lawrence Berkeley Lab., CA). *Journal of the Chinese Chemical Society (Taipei);* **32**: No. 3, 179-185(Sep 1985). Contract AC03-76SF00098.

The reactions of electronically excited sodium atoms with simple molecules have been studied in crossed molecular beams experiments. Electronically excited Na(3^{2}P/sub 3/2/,4^{2}D/sub 5/2/, and 5^{2}S/sub 1/2) were produced by optical pumping using single frequency dye lasers. The effects of the symmetry, and the orientation and alignment of the excited orbital on the chemical reactivity, and detailed information on the reaction dynamics were derived from measurements of the product angular and velocity distributions.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 11834, 12014

12020 **(AD-A—185122/9/XAB) Chemistry and electrochemistry associated with the electroplating of Group VIA transition metals.** White, S.H.; Twardoch, U.M. (EIC Labs., Inc., Norwood, MA (USA)). 1987. 19p. NTIS, PC A03/MF A01.

An overview of the requirements for the electroplating of refractory metals from molten salts is presented, followed by a discussion of recent electrochemical studies that have been carried out to delineate the solution chemistry of alkali-metal-halide plating baths. New results for halide baths involving chromium and molybdenum are presented and considered from the view of both solution chemistry and electrocrystallization processes of these metals. Advantages and disadvantages of these electrolytes are discussed in the context of plating-cell development and pulse-modulated plating techniques.

4005 Photochemistry

12021 **(PB—88-853908/XAB) Chemiluminescence: measuring methods. January 1970-November 1987 (citations from the NTIS data base). Report for January 1970-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 123p. NTISPC N01/MF N01.

Supersedes PB—85-868289.

This bibliography contains citations concerning the chemiluminescence analysis of substances. Sample system design, sample collection methods, measurement techniques, and sensitivity of the instrumentation are discussed. High-altitude air-pollution studies are emphasized. (This updated bibliography contains 232 citations, 16 of which are new entries to the previous edition.)

12022 **Diode laser absorption probe of vibration-vibration energy transfer in CO_2.** Kreutz, T.G.; O'Neill, J.A.; Flynn, G.W. (Columbia Univ., New York, NY). *Journal of Physical Chemistry;* **91**: No. 22, 5540-5543(22 Oct 1987). Contract AC02-78ER04940.

Time domain absorption spectroscopy with a tunable diode laser has been used to measure the rate constant for vibration-to-vibration energy transfer in CO_2 via the near-resonant collision uppumping process $CO_2(00^01) + CO_2(00^01) \rightleftharpoons CO_2(00^02) + CO_2(00^00)$. The diode laser, in combination with a CO_2 discharge reference cell, is used to monitor the time-dependent population increase within the $CO_2(00^02)$ state in a 10:1 mixture of Ar and CO_2 following pulsed excitation of the $CO_2(00^01)$ level by a Q-switched CO_2 laser. The intramode relaxation rate constant, k, for this process is found to be (5.6 +/- 0.7) x 10^6 s^{-1} Torr^{-1} or (1.7 +/- 0.2) x 10^{-10} cm^3 s^{-1} molecule^{-1} at 298 K.

12023 **Laser flash photolysis study of pivalothiophenone triplets. Steric and electronic effects in thione photoreaction kinetics.** Bhattacharyya, K.; Ramamurthy, V.; Das, P.K. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **91**: No. 22, 5626-5631(22 Oct 1987).

Upon laser pulse excitation (λ/sub ex/ = 532 nm) into the lowest-lying $^1(n,\pi^*)$ band system, pivalothiophenones in benzene solutions give rise to short-lived triplets (λ/sub max//sup T/ = 325-335 nm, epsilon/sub max//sup T/ = (11-15) x 10^3 M^{-1} cm^{-1}) with quantitative intersystem crossing efficiencies. The triplet yields decrease slightly (by 10-30%) upon changing λ/sub ex/ to 308 nm (i.e., upon excitation into S_2). Kinetic data are presented for intrinsic triplet lifetimes, self-quenching, and quenching by oxygen, di-tert-butylnitroxy radical, and various reagents capable of interacting with the triplets via energy, electron, or hydrogen-atom transfer and by biradical formation (possibly leading to cycloaddition). The mechanisms of the quenching processes are discussed. Relative to rigid aromatic thiones, namely, xanthione and thiocoumarin, the interaction of pivalothiophenone triplets with most of the quenchers are kinetically inefficient. This is interpreted primarily as a manifestation of the steric crowding at positions a to the thiocarbonyl group.

12024 **Rate constant measurements of reactions of C_2H with H_2, O_2, C_2H_2, and NO using color center laser kinetic spectroscopy.** Stephens, J.W.; Hall, J.L.; Solka, H.; Yan, W.B.; Curl, R.F.; Glass, G.P. (Rice Univ., Houston, TX). *Journal of Physical Chemistry;* 91: No. 22, 5740-5743(22 Oct 1987). Contract FG05-85ER13439.

The rate constants for the reactions of the ethynyl radical (C_2H) with H_2, O_2, C_2H_2, and NO have been measured by following the time decay of an C_2H infrared transient absorption line originating from the ground vibronic state using color center laser spectroscopy. For the H_2, O_2, and NO reactions, the C_2H was produced by excimer laser flash photolysis (ArF, 193 nm) of CF_3C_2H. In the case of the C_2H_2 reaction C_2H was produced by flash photolysis of acetylene again using the 193-nm ArF excimer line. Excited states of C_2H, which are abundant with 193-nm photolysis, were relaxed by buffering the photolysis cell with ~ 20 Torr of He buffer and ~ 160 mTorr of SF_6. Rate constants of 4.2 x 10^{-11}, 4.8 x 10^{-12}, 1.5 x 10^{-10}, and 3.5 x 10^{-11} cm^3 $molecule^{-1}$ s^{-1} were obtained for the reactions of C_2H with O_2, H_2, C_2H_2, and NO, respectively.

12025 **Photogenerated catalysis in metal-organic systems. 3. Catalyzed valence isomerization of quadricyclene to norbornadiene via photochemical generation of a strong ground-state oxidant.** Kutal, C.; Kelley, C.K.; Ferraudi, G. (Univ. of Georgia, Athens). *Inorganic Chemistry;* 26: No. 20, 3258-3261(7 Oct 1987).

Irradiation of an acetonitrile solution containing tris(2,2'-bipyridine)ruthenium(II) ($Ru(bpy)_3^{2+}$), the methylviologen dication (MV^{2+}), and quadricyclene (Q) with 436-nm light initiates a catalytic cycle for the conversion of Q to its more stable valence isomer norbornadiene (NBD). Quantum yields of NBD production above 1 and turnovers of $Ru(bpy)_3^{2+}$ greater than 10^3 have been measured. Spectral, continuous-photolysis, flash-photolysis results support a mechanism in which the primary photochemical step is oxidative quenching of the emissive metal-to-ligand charge-transfer excited state of $Ru(bpy)_3^{2+}$ by MV^{2+} to form the strong ground-state oxidant, $Ru(bpy)_3^{3+}$. Subsequent oxidation of Q by $Ru(bpy)_3^{3+}$ regenerates the original metal complex and produces the structurally labile cation radical, Q/sup .+/. Rearrangement of Q/sup .+/ to NBD/sup .+/ and oxidation of another Q molecule by NBD/sup .+/ constitute the key chain-carrying steps in the catalytic oxide. 25 references, 2 figures, 1 table.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 10963, 12730, 12737

12026 **(CIEMAT—597) Enzymatic activity of the cellulolytic complex produced by trichoderma reesei. Enzymatic hydrolysis of cellulose.** Alfonsel Jaen, M.; Negro, M.J.; Saez, R.; Martin Moreno, C. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1986. 43p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701252/JAW.

The enzymatic activity characterization of the cellulolytic complex obtained from Trichoderma reese QM 9414 and the influence of the enzymatic hydrolysis conditions on the hydrolysis yield are studied. Pure cellulose and native or alkali pretreated biomass from Onopordum nervosum have been used as substrates. The values of pH, temperature, substrate concentration and enzyme-substrate ratio for the optimum activity of that complex, evaluated as glucose and reducing sugars productions, have been selected. Previous studies on enzymatic hydrolysis of O. nervosum have shown a remarkable effect of the alkaline pretreatments on the final hydrolysis yield. (author). 10 figs.; 10 refs.

12027 **(CONF-870701—13) Gas phase pulse radiolysis.** Jonah, C.D.; Andong Liu; Mulac, W.A. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002981/JAW.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

Gas phase pulse radiolysis, a technique which can be used to study many different phenomena in chemistry and physics, is discussed. As a source of small radicals, pulse radiolysis is important to the field of chemistry, particularly to combustion and atmospheric kinetics. The reactions of 1,3-butadiene, allene, ethylene and acetylene with OH are presented. 52 refs., 1 fig., 1 tab.

12028 **(CONF-8710229—1) Electron transfer to iron(III) oxide colloids.** Mulvaney, P.; Grieser, F.; Swayambunathan, V.; Meisel, D. (Melbourne Univ., Parkville (Australia). Dept. of Physical Chemistry; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002885/JAW.

From Conference on photoelectrochemistry and electrosynthesis on semiconducting materials; Honolulu, HI, USA (18 Oct 1987).

The electron transfer reaction from viologen radicals to colloidal iron(III) oxide and oxyhydroxide particles was investigated by pulse and steady-state radiolysis techniques. The rate of electron injection to oxyhydroxide particles was clearly controlled by their surface charge and in the region near the isoelectric point, the electron transfer rate is slower than the diffusion-controlled rate by at least two orders of magnitude. Conductivity measurements clearly reveal the occurrence of protonation reactions immediately following the initial electron transfer step. On the basis of the experimentally measured ratio of protons consumed to electrons injected, a mechanistic pathway describing the sequence of protonation reactions is proposed. The competition between surface trapping of charge and the migration of charge into the interior of the particles and the factors controlling these two events are also discussed. 17 refs., 3 figs.

12029 (INIS-SU—430, pp 85) **Radiation polymerization for reactions of heterogenezation and immobilization reactions.** Garnett, J.L. (AN SSSR, Moscow. Inst. Organicheskoj Khimii). 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

12030 (INIS-SU—430, pp 102) **Novel supported metal complex catalysts prepared using gamma radiation.** Hartley, F.R.; Murray, S.G.; Sayer, A.T. 1986. NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

12031 (INIS-SU—430, pp 268) **Grafting with the use of γ-radiation as the new method for preparation of stable and highly selective supported metal-complex catalysts.** Khartli, F.R. 1986. (In Russian). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780045/JAW. (CONF-8607351—).

From 5. international symposium on relations between homogeneous and heterogeneous catalysis; Novosibirsk, USSR (15 Jul 1986).

12032 **Radiation chemical studies with heavy ions: oxidation of ferrous ion in the Fricke dosimeter.** La Verne, J.A.; Schuler, R.H. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* 91: No. 22, 5770-5776(22 Oct 1987).

The yields for oxidation of ferrous ions in the Fricke dosimeter have been determined for ^{4}He, ^{7}Li, ^{9}Be, ^{11}B, and ^{12}C ions with energies up to 35 MeV. These particles have a linear energy transfer (LET = -dE/dx) in water of up to 20 eV/A for ^{4}He ions and 100 eV/A for ^{12}C ions. For these high LET particles the radiation chemical yields for ferric production, which range from ~ 3 to ~ 8, are appreciably lower than for fast electrons (15.5). The differential yields determined from the observed energy dependences show that the yields are not uniquely determined by LET but increase with increased atomic number (Z) of the irradiating particle. Related measurements on deaerated solutions provide detailed information on the dependences of the H atom and water decomposition yields on particle type and energy and show that there is, at a given LET, increased diffusion of H atoms out of the track with increase in Z. However, at high energies this effect becomes relatively less important because of increase in the track radius. There is an indication that for heavy ions of very high energies the limit at low LETs may be well below the yield for fast electrons because energy is deposited in more dense spurs. The yield of H atoms which escape the track at the Bragg peak decreases from 0.30 for ^{4}He ions to 0.09 for ^{12}C ions. The low-energy limiting yields for particles of very high LET are less than 0.01 for H atom production and ~ 2.8 for water decomposition. This report includes a comprehensive summary of previous studies of the Fricke system with heavy ion radiations.

12033 **Yields of chemical species in irradiated liquid water - A comparison between Monte Carlo calculations and experimental data.** Bolch, W.E.; Wright, H.A.; Turner, J.E.; Hamm, R.N.; Klots, C.E. (Dept. of Energy Health Physics Fellow, Dept. of Environmental Engineering Sciences, Univ. of Florida, Gainesville, FL 32605). pp 93 of Thirty-fifth annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1987). (CONF-870221—). Contract AC05-84OR21400.

From 35. annual meeting of the Radiation Research Society; Atlanta, GA, USA (22 Feb 1987).

A detailed Monte Carlo code has previously been written to model the physical and chemical events occurring in irradiated liquid water to times of —10/sup -6/ s after irradiation. In this work, the model was used to make direct comparisons against measured time-dependent yields of the OH radical and the hydrated electron. The assumed physical changes occurring at early times (10/sup -15/ s to 10/sup -11/s) which lead to satisfactory agreement are discussed. Additional comparisons were made against Fricke dosimeter yields for alphas, protons, and tritium betas.

12034 **The Fricke dosimeter: A 1-hit detector.** Sinclair, G.L.; Waligorski, M.P.R.; Katz, R. (Univ. of Nebraska, Lincoln, NE 68588-0111). pp 119 of Thirty-fifth annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1987). (CONF-870221—).

From 35. annual meeting of the Radiation Research Society; Atlanta, GA, USA (22 Feb 1987).

A new analytic expression for the radial dose distribution, from a Monte Carlo calculation in liquid water, has led to a recalculation of the relative response of the Fricke dosimeter irradiated with heavy ions, as a 1-hit detector using track theory. For particles above 1 MeV/μ agreement with data approximates experimental error. The model parameter a/sub o/ is consistent with the observed approach to saturation with Fe++ concentration at about 1 mM. Together with the fitted value of the parameter E/sub o/ the authors find an energy deposition of about 60 eV per sensitive volume. The 1-hit model implies a decline in yield with increasing dose, as observed. The authors need only 2 parameters and the radial dose distribution, but have no need for track core, reaction rates, diffusion constants, differential equations, and an array of reactions. An appropriate fusion of track theory and diffusion kinetics could be made if the parameters of track theory could be derived from diffusion kinetics for gamma-ray or electron irradiation.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 10910

12035 **(CIEMAT—594) Effects of temperature and gamma radiation on the stability of /sup 125/I-19-iodocholesterol.** Rebollo, D.V.; Rodriguez, L.; Ruiz, J.M. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1986. 24p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701249/JAW.

The effect of the temperature and the gamma radiations on the /sup 125/I-19-iodocholesterol synthesized in our laboratory, has been studied; the time of caducity (t90) have been fixed from the rate constants of decomposition (k-bar) (20,9; 32,1 y 144.10/sup -3/ h/sup -1/) for different temperatures (35, 50 and 75/sup o/C), and the value of Go(-M) (1,52) by radiation of samples of 19-iodocholesterol-/sup 125/I (0,94 mg/ml) with /sup 60/Co (0,177 Mrad/h). (author). 4 figs., 8 refs.

12036 **(CIEMAT—603) Radiochemical determination and separation of total radium, radium 226 and radium 224.** Suarez, J.A.; Gonzalez, J.A.; Pablo, M.A. de. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 36p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701258/JAW.

Radiochemical purification and separation of radium has been carried out and the determination of total radium solubilized in aqueous samples has been studied assuming that all the alpha emiters of the sample have their origin in the /sup 226/Ra and elements of its desintegration chain. Also, the activities of /sup 224/Ra and /sup 226/Ra have been evaluated separately doing a measurement after the chemical separation of the radium and another one 10 days after. (author). 3 figs., 9 refs.

12037 **(CONF-8709189—6) Continuing investigations for technology assessment of ^{99}Mo production from LEU [low enriched Uranium] targets.** Vandergrift, G.F.; Kwok, J.D.; Marshall, S.L.; Vissers, D.R.; Matos, J.E. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003021/JAW.

From International RERTR meeting; Buenos Aires, Argentina (28 Sep 1987).

Currently much of the world's supply of /sup 99m/Tc for medical purposes is produced from ^{99}Mo derived from the fissioning of high enriched uranium (HEU). The need for /sup 99m/Tc is continuing to grow, especially in developing countries, where needs and national priorities call for internal production of ^{99}Mo. This paper presents the results of our continuing studies on the effects of substituting low enriched Uranium (LEU) for HEU in targets for the production of fission product ^{99}Mo. Improvements in the electrodeposition of thin films of uranium metal are reported. These improvements continue to increase the appeal for the substitution of LEU metal for HEU oxide films in cylindrical targets. The process is effective for targets fabricated from stainless steel or hastaloy. A cost estimate for setting up the necessary equipment to electrodeposit uranium metal on cylindrical targets is reported. Further investigations on the effect of LEU substitution on processing of these targets are also reported. Substitution of uranium silicides for the uranium-aluminum alloy or uranium aluminide dispersed fuel used in other current target designs will allow the substitution of LEU for HEU in these targets with equivalent ^{99}Mo-yield per target and no change in target geometries. However, this substitution will require modifications in current processing steps due to (1) the insolubility of uranium silicides in alkaline solutions and (2) the presence of significant quantities of silicate in solution. Results to date suggest that both concerns can be handled and that substitution of LEU for HEU can be achieved.

12038 **(DOE/ER/40329—1) Research in actinide chemistry: Progress report, March 1, 1987-February 29, 1988.** (Florida State Univ., Tallahassee (USA)). 1987. Contract FG05-87ER40329. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003436/JAW.

Results are presented of research with actinides, which addressed the following areas: redox reactions of NpO_3^{2+} and reaction kinetics; dissociation kinetics of Th-Humate complex, UO_2-Humate complex, and Sm-Humate complex; pulse radiolysis of uranyl-polyelectrolyte complexes; time-resolved fluorescence of Eu(III); solvent extraction of Eu^{3+} and Am^{3+}; and the synergistic extraction of Am^{3+}, Th^{4+}, and UO_2^{2+} by TTA and PMBP crown ethers.

12039 **(INIS-mf—11609) Experiments toward the development of a radioimmunoassay for the detection of serum antibodies for the respiratory syncytial virus.** Heizmann, W.R. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88751934/JAW.

In order to detect an infection by the respiratory syncytial virus (RSV) quickly and safely, a radioimmunassay (RIA) should be developed. Various antigen preparations were compared to one another. The immune serums used in the RIA came from guinea pigs with a RSV antibody titer of up to 320 in the complement binding reaction. A number of observations lead to the discussion of the possibility of the formation (incomplete) of cross-reactive antibodies between virus and host cell. This hypothesis could be well supported through references in the literature. Under the assumption of the existence of cross-reactive antibodies, a further model of the pathogenesis of the RSV illness allows itself to be developed, which could be preceived as an illness with autoimmune components. With this model the varying courses of this disease in different age groups can be easily explained.

12040 **(JINR-R—6-86-829) Electromigration of carrier-free radioisotopes. Mobility and hydrolysis of Np(5) ions in perchlorate solutions.** Resh, F.; Milanov, M.; Chan Kim Khung; Lyudvig, R.; Buklanov, G.V.; Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701168/JAW.

Submitted to the journal Radiochim. Acta.

The /sup 239/Np(5) carrier-free ion mobility in the solutions HClO/sub 4/-NaClO/sub 4/-NaOH has been measured in the range $1 \leq pH < 13$. On the basis of experimental data the hydrolysis constants of NpO/sub 2//sup +/ ion have been calculated as $p\beta$/sub 1/10.45(25) and $p\beta$/sub 2/=21.96(35). The individual ion mobilities of Np(5) have been found to be u/sub (NpO(sub 2+))//sup 0/=+4.20(10)x10/sup -4/ cm/sup 2/V/sup -1/s/sup -1/ and u/sub (NpO(sub 2)(OH)(sub 2-))/=4.55(30)x10/sup -4/ sm/sup 2/V/sup -1/s/sup -1/. It has been revealed that the ion mobility of Np(5) decreases in acid solutions (pH=1-2) compared with neutral ones (pH=5.5-7.5). This effect is explained as due to the formation of the compound NpO/sub 2//sup +/xH/sub 3/O/sup +/ with the protonation constant $p\beta$/sub 1/ ≅ 1x10/sup -4/. 20 refs.; 1 fig.; 2 tabs.

12041 **(JINR-R—12-87-120) Study of astatine sorption on ion exchange resins and palladium from aqueous halogenide solutions in purification of ultralow quantities of transplutonium elements from astatine.** Eichler, B.; Bruchertseifer, H.; Korotkin, Yu.S.; Ehsteves, Kh. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic; Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Nuclear Reactions). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701185/JAW.

Under the process of identification of new elements by daughter α - active isotopes of transplutonium elements (TPE) the high degree of their purification from α-active isotopes of elements like astatine is required. The data on sorption of astatine and terbium on strong acid and strong basic anion exchange resin as well as on palladium silica gel are given. The combined application of these sorbents allows one to obtain the degree of chromatographic purification of daughter isotopes /sup 253/Fm and /sup 253/Es from At upto a factor of 10/sup 8/-10/sup 10/. The results of purification of TPE from α-emitter background satisfy the requirements of registration of single α-decays of TPE during tens and hundreds of hours of measurements in the experiments on the synthesis of heavy TPE. 14 refs.; 4 figs.

12042 **(KAERC—402/86) Study on colloidal solution preparation of radioisotope /sup 198/Au.** Kim Yeh Zip; Choe Sun Nam. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). 30 Sep 1986. 6p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701391/JAW.

The factors influencing the preparation and particle's size of the /sup 198/Au colloidal solution widely used in diagnosis and treatment on medical science are considered in this paper. It was established that preparation temperature of 80/sup 0/C, pH 9, concentration of reducible agent of 5% and concentration of stable agent of 4% are optimum conditions for the making the colloidal particles of size of 10-30μm. The distributive property of colloidal particles and stability of radioactive /sup 198/Au colloidal solution on the method of adding the solution of colloidal core and reducible agent are also considered.

12043 **(ORNL/TM—10531) Nuclear medicine progress report for quarter ending June 30, 1987.** Knapp, F.F. Jr.; Allred, J.F.; Ambrose, K.R.; Callahan, A.P.; Rice, D.E.; Srivastava, P.C. (Oak Ridge National Lab., TN (USA)). Jan 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004766/JAW.

The performance of two tungsten-188/rhenium-188 (W-188/Re-188) radionuclide generator systems utilizing either alumina (Al_2O_3) eluted with physiological saline or hydrated zirconium oxide (HZO) eluted with methyl ethyl ketone are described. Because of its emission of high-energy β^- and availability from a reactor-produced parent (W-188) with a long (T/sub 1/2/ 69 days) half-life, Re-188 is an excellent candidate for various therapeutic applications. Both systems gave reproducible daily yields over several weeks with very low W-188 parent breakthrough. The production of W-188 in the High Flux Isotope Reactor (HFIR) was evaluated, and a one cycle irradiation (21 d) of enriched W-186 gave W-188 with a specific activity of 3.5 mCi/mg W-186. The results demonstrate that W-188/Re-188 generators with reproducible performance, long shelf-life and high yields of Re-188 can be prepared from both HZO and Al_2O_3. The isolation of a polar catabolite from isolated Langendorff-perfused rat hearts administered the radioiodinated 3-methyl-branched fatty acid, 15-(p-iodophenyl)-3-R,S-methylpentadecanoic acid (BMIPP), is described. This is the first demonstration of the identification of the release of an apparent metabolite associated with the myocardial clearance of BMIPP and suggests that the formation of such a catabolite may occur in vivo. 12 refs., 5 figs.

12044 **(PNL-SA—14675) Decontamination technology: A US perspective.** Allen, R.P. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1987. Contract AC06-76RL01830. 11p. (CONF-871018—15). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001904/JAW.

From International decommissioning symposium; Pittsburgh, PA, USA (4 Oct 1987).

This paper provides an overview of advances and applications to provide a US perspective for the decontamination technology and applications presented at the 1987 Symposium. 35 refs.

12045 **(RI—185) Mass-spectrometric study of volatile uranyl β-diketonates and their adducts.** Adamov, V.M.; Belyaev, B.N.; Berezinskij, S.O.; Sidorenko, G.V.; Suglobov, D.N. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1985. 45p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701225/JAW.

The mass spectra of a number of uranyl β-diketonates containing methyl, trifluoromethyl and tert-butyl substituents in β-dike-

tonate anion, and their adducts are measured. The form of the unsolvated β-diketonates and their adducts in gas phase is studied. The ways of fragmentation of uranyl β-diketonates and their adducts are investigated. The data concerning the thermal and chemical side reactions proceeding with uranyl β-diketonates and their addicts in an ion source are obtained. The mass spectra of the samples of neptunyl and plutonyl β-diketonate adducts synthesized for the first time are measured. 70 refs.; 13 tabs.

12046 **Carrier-free astatination of steroid hormones.** Pillai, K.M.R.; McLaughlin, W.H.; Bloomer, W.D.; Lambrecht, R.M. (Mount Sinai School of Medicine, New York, USA; Brookhaven National Lab., Upton, NY, USA). *Journal of Labelled Compounds and Radiopharmaceuticals;* 24: No. 9, 1117-1122(Sep 1987).

The alpha emitting radiohalogen /sup 211/At has potential use as a radiotherapeutic agent when linked to biologically active molecules. The range of compounds which may be astatinated is limited by relative lack of knowledge of organoastatine syntheses. The production of astatovinyl steroids was carried out via electrophilic substitution of tri-n-butylstannylvinyl steroids with astatide in the presence of mild oxidizing agents. The astatinated steroids are synthesized rapidly and in carrier-free fashion yielding compounds of high radiochemical purity.

12047 **Synthesis of a radiobrominated analog of SCH 23390, a selective dopamine D_1/DA_1 antagonist.** De Jesus, O.T.; Van Moffaert, G.J.; Glock, D.; Goldberg, L.I.; Friedman, A.M. (Chicago Univ., IL, USA. Dept. of Radiology; Chicago Univ., IL, USA. Dept. of Pharmacology; Chicago Univ., IL, USA. Dept. of Pharmacology; Chicago Univ., IL, USA. Dept. of Medicine; Chicago Univ., IL, USA. Dept. of Radiology; Argonne National Lab., IL, USA). *Journal of Labelled Compounds and Radiopharmaceuticals;* 23: No. 9, 919-925(Sep 1986).

A radiobrominated analog of SCH 23390, a selective dopamine D_1/DA_1 antagonist was prepared. Radiochemical yields of up to 60% were obtained within 15 minutes reaction at room temperature. The synthesis was validated by performing both physical (NMR and mass spectroscopy) and biological tests on the product. Preliminary studies suggest that ^{75}Br-labelled SCH 23390 analog would be a useful ligand for the studies of CNS dopamine D_1 receptors by positron emission tomography.

12048 **Simple one-pot synthesis of cyclopropane [^{11}C] carbonyl chloride. Synthesis and biodistribution of [^{11}C] cyclorphan.** McPherson, D.W.; Hwang, D.-R.; Fowler, J.S.; Wolf, A.P.; MacGregor, R.M.; Arnett, C.D. (Brookhaven National Lab., Upton, NY, USA). *Journal of Labelled Compounds and Radiopharmaceuticals;* 23: No. 5, 505-514(May 1986).

A rapid, one-pot, synthesis of cyclopropane [^{11}C] carbonyl chloride was developed. This synthesis proceeded in 80% radiochemical yield (EOB) in a synthesis time of 10 minutes. This acid chloride was then used to synthesize a model compound, [^{11}C]cyclorphan, by alkylation of norlevorphanol followed by reduction of the intermediate [^{11}C]amide in an overall synthesis time of 55 minutes and a radiochemical yield of 15% (EOB). The biodistribution of [^{11}C]cyclorphan in control and naloxone pretreated mice showed non-specific binding and rapid clearance from brain.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 10791, 12004, 12024, 13814

12049 (CONF-8706187—, pp 1-12) **High speed tomographic optical data acquisition system for combustion research.** Snyder, R.; Hesselink, L. (Stanford Univ., CA). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Optical tomography provides a means for obtaining spatially resolved measurements from line-of-sight data. Classical flow visualization approaches such as shadowgraphy, schlieren and interferometry provide information about physical observables averaged along the path of the probe beam. Locally resolved measurements cannot be obtained from such data sets, except for axially symmetric or two-dimensional flows. Tomography has been applied to medical and industrial applications. Particularly in medicine, tomographic diagnostics are well developed. Since medical objects tend to be stationary, data acquisition times need not be very rapid and sequential acquisition of projections is sufficient. In fluid mechanics no such luxury is usually allowed, since the most interesting flows are unsteady and rapidly developing. This requires that tomographic data acquisition systems have a very short response time and all projections must be collected in such a short time that the flow is essentially frozen. A new optical architecture is described that is capable providing 36 equally spaced projections about a 180 degree arc in 300 μsec. Each projection passes through a three inch diameter, three inch high cylinder, allowing a full three-dimensional reconstruction of the flow in that region. Holographic interferometry allows direct measurement of optical phase along the pathlength. From these data, the flow may be reconstructed using any of the available reconstruction techniques. The design of the optical apparatus is described, followed by an outline of the experiment, the data reduction scheme and the results obtained with this method.

12050 **(N—88-11414) Adaptive pseudo-spectral method for reaction diffusion problems.** Bayliss, A.; Gottlieb, D.; Matkowsky, B.J.; Minkoff, M. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1987. 43p. (NASA-CR—178394; ICASE—87-67; NAS—1.26:178394). NTIS, PC A03/MF A01.

The spectral interpolation error was considered for both the Chebyshev pseudo-spectral and Galerkin approximations. A family of functionals I sub r (u), with the property that the maximum norm of the error is bounded by I sub r (u)/J sub r, where r is an integer and J is the degree of the polynomial approximation, was developed. These functionals are used in the adaptive procedure whereby the problem is dynamically transformed to minimize I sub r (u). The number of collocation points is then chosen to maintain a prescribed error bound. The method is illustrated by various examples from combustion problems in one and two dimensions.

12051 **(ORNL/Sub—84-89677/1) The effects of fuel composition on ignition delay in homogeneous charge and direct injection compression ignition engines.** Foster, D.E.; Dimpelfeld, P.M.; Boggs, D.L.; Bair, R.E.; Borman, G.L. (Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering). Nov 1987. Contract AC05-84OR21400. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003691/JAW.

This report describes the work done at the University of Wisconsin-Madison in two experimental programs. In one program comparisons were made between comprehensive chemical kinetic mechanisms and experimental data for a homogeneous charge engine that was operated in either a spark ignited or compression ignited mode. The aim was to make an assessment of our ability to model the combustion of real fuels in I.C. engines. In the second program the effect of fuel composition on diesel engine performance was evaluated. In particular the effect of the chemical composition of the volatile fraction was examined for its effect on ignition properties and emissions of a direct injection diesel engine. Two analytics were prepared for this document.

12052 (ORNL/Sub—84-89677/1, pp 1-91) **A study of autoignition in a premixed charge internal combustion engine using comprehensive chemical kinetics: Experiments and predictions.** Nov 1987. NTIS, PC A07/MF A01. Order Number DE88003691/JAW.

In The effects of fuel composition on ignition delay in homogeneous charge and direct injection compression ignition engines.

To effect a comparison between comprehensive chemical kinetic mechanisms and experimental data a model was developed to predict autoignition in a premixed charge engine. Experimental data were obtained with spark ignition and premixed charge compression ignition. Seven fuels were examined: methane, ethane, propane, n-butane, methanol, ethylene, and propylene. Binary fuel mixtures

were also examined, as were the effects of engine speed, equivalence ratio, load, and compression ratio. An initial temperature correction must be used to correctly predict the observed time of autoignition. Analysis of spark-ignited data show that the fuels fall into two groups, depending on the temperature correction required. Four fuels fall into the group with a temperature correction ranging from 35°K to 80°K: methane, propane, n-butane, and methanol. Three fuels fall into the group with a temperature correction ranging from 110°K to 140°K: ethane, ethylene, and propylene. The rate of pressure rise during compression ignition was controlled by varying the fuel-air equivalence ratio. The effects of compression ratio and load on the rate of pressure rise were also examined. The predicted rates of temperature rise during compression ignition were compared to the observed rates of temperature rise. The predicted maximum rates were from 40 to 300 times greater than the observed maximum rates. The lowest predicted rates were obtained for n-butane, while the highest predicted rates were obtained for ethane. 31 refs., 51 figs., 4 tabs.

12053 (ORNL/Sub—84-89677/1, pp 93-121) **Diesel combustion and ignition properties of fuels with different volatile fraction constituents.** Nov 1987. NTIS, PC A07/MF A01. Order Number DE88003691/JAW.

In The effects of fuel composition on ignition delay in homogeneous charge and direct injection compression ignition engines.

Six specially blended diesel fuels were tested in an open chamber TACOM-LABECO single cylinder diesel engine at turbocharged conditions, to determine if the chemical composition of the volatile fraction of the fuels had a significant effect on performance and emissions. The tests show that for this engine, which has a moderately high swirl and a four hole nozzle, the effects are very small. Additional tests were run, with these same fuels, in a homogeneous autoigniting mode to determine if ignition trends were similar to those produced by the heterogeneous diesel ignition. The ignition delay trends were found to follow the same pattern, reinforcing the conclusion that the fuel combustion in the diesel was not significantly affected by distillation effects during the vaporization process. 10 refs., 10 figs., 6 tabs.

42 ENGINEERING

REFER ALSO TO CITATION(S) 11630

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 10671, 10839, 10942, 10943, 10944, 11027, 11040, 11054, 11194, 11715, 11747, 12220, 12221, 12271, 12392, 13709, 13877

12054 (AD-A—184979/3/XAB) **Psychological effects of sustained operations in a simulated NBC (nuclear, biological or chemical) environment on M1 tank crews. Technical report, May-June 1985.** Munro, I.; Rauch, T.M.; Banderet, L.E.; Lussier, A.R.; Tharion, W.J. (Army Research Inst. of Environmental Medicine, Natick, MA (USA)). 3 Jul 1987. 77p. (USARIEM-T—26-87). NTIS, PC A05/MF A01.

Forty-eight M1 crewmen were tested in a temperate climate under conditions simulating 72-hour operations in an area contaminated with chemical agents. Over 50% of the crewman voluntarily withdrew from the test, and maximum unit endurance did not exceed 32 hours. Two problems were found to be related to endurance failure. Soldiers who withdrew reported more intense symptoms associated with respiratory distress than did those who remained in the test. In addition, soldiers who withdrew experienced greater cognitive difficulties. Near-term countermeasures, assessed in some test iterations, showed no significant endurance-extending effects. Alternative solutions based on the identified problems were proposed.

12055 (AD-A—184994/2/XAB) **Magnetocaloric refrigeration. Research and development report.** Green, G.; Patton, G.; Stevens, J.; Humphrey, J. (David W. Taylor Research and Development Center, Bethesda, MD (USA)). Mar 1987. 46p. (DTNSRDC—87/032). NTIS, PC A03/MF A01.

The magnetocaloric refrigerator uses the adiabatic temperature response of ferromagnetic materials (rare-earth metals) in a high magnetic field. A mathematical model of a reciprocating magnetic refrigerator having an active element of a rare-earth metal predicted that a 60-K temperature span could be achieved. Based on the model's results, an experimental refrigerator was fabricated and the thermal characteristics of an active regenerator in a reciprocating apparatus were measured. The active material was gadolinium, which has a Curie temperature of 293 K and was formed into an embossed ribbon geometry. Significant regeneration in the magnetic material was observed, and a 50-K temperature span was achieved. A cold end temperature of 246 K was measured. The results indicated that the active regeneration concept can successfully produce magnetocaloric refrigeration at temperatures near the Curie temperature of the material, and the measured temperature span verified the mathematical model developed to describe the process. Further, if the active magnetic element were a combination of several rare-earth metals having significant magnetocaloric effects at decreasing temperatures, the possibility exists for producing a single-stage magnetic refrigerator that could operate over a very large temperature span.

12056 (AD-A—185194/8/XAB) **Heat exchange during encapsulation in a Chemical-Warfare Agent Protective Patient Wrap in four hot environments. Technical report.** Stephenson, L.A.; Kolka, M.A.; Allan, A.E.; Santee, W.R. (Army Research Inst. of Environmental Medicine, Natick, MA (USA)). Apr 1987. 38p. (USARIEM-T—10/87). NTIS, PC A03/MF A01.

The purpose of this study was to determine safe encapsulation time limits in four hot environments including a simulated solar heat load and thereby generate an equation predicting safe time limits for hot environments. Eight male subjects were studied during encapsulation in a Chemical Warfare Agent Protective Patient Wrap in each of four environments. Rectal temperature, mean skin temperature, mean body temperature air temperature and dew point temperature within the wrap and wrap temperature were measured every minute. Metabolic rate was measured during encapsulation by partitional calorimetry. The data shows that safe encapsulation time is severely limited in Hot/Dry and Hot/Wet environments when a solar heat load is included.

12057 (AD-A—185258/1/XAB) **Development of a low-noise 10-K J-T refrigeration system. Technical progress report, 15 August 1986-15 February 1987.** Little, W.A. (MMR Technologies, Inc., Mountain View, CA (USA)). 15 Feb 1987. 9p. NTIS, PC A02/MF A01.

This report summarizes work on the development of a low-noise Joule-Thomson, microminiature refrigeration system, designed for 10 K operation. Two events since the last report have had an important influence on the confirmation through a series of experimental measurements of the remarkable cooling power at 80 to 90 K of the nitrogen-hydrocarbon gas mixtures discussed briefly in the previous report. These experiments confirmed that these mixtures could give a refrigeration an order of magnitude greater than that attainable with argon or nitrogen at the same input pressures. In addition, it was recognized that this high efficiency allowed one to use a heat exchanger of substantially smaller surface area and a compressor designed for operation at much lower pressures. This lower-pressure operation would greatly reduce the wear of the piston seals and thereby prolong the life of the system. It was also discovered in the course of these measurements that the use of the gas mixtures resulted in virtually clog-free operation of the refrigerators.

12058 (CONF-8706187—, pp 123-130) **Experiments in autonomous robotics.** Hamel, W.R. (Oak Ridge National Lab., TN). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW. Contract AC05-84OR21400.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

The Center for Engineering Systems Advanced Research (CESAR) is performing basic research in autonomous robotics for energy-related applications in hazardous environments. The CESAR research agenda includes a strong experimental component to assure practical evaluation of new concepts and theories. An evolutionary sequence of mobile research robots has been planned to support research in robot navigation, world sensing, and object ma-

nipulation. A number of experiments have been performed in studying robot navigation and path planning with planar sonar sensing. Future experiments will address more complex tasks involving three-dimensional sensing, dexterous manipulation, and human-scale operations.

12059 (CONF-8706187—, pp 236-243) **Application of acoustic emission techniques to cryogenic experiments.** Iwasa, Y. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

The application of acoustic emission techniques in cryogenic experiments is discussed. The techniques have proven effective in diagnosing superconducting magnets: they can also be used to quantify dissipative energies released in tensile and fracture experiments.

12060 (CONF-8706187—, pp 244-251) **Modeling and analysis of surface cracks.** Parks, D.M. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Numerical solutions examining the range of applicability of dominant singularity approaches to ductile fracture of structures are explored, as well as the development of simplified, but accurate analytical models.

12061 (CONF-8706187—, pp 252-258) **Solids with multiple cracks and some related problems.** Kachanov, M. (Tufts Univ., Medford, MA). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A simple method of analysis of crack interactions in elastic solids based on a superposition technique is presented. The method applies to both two- and three-dimensional crack arrays of arbitrary geometry and yields approximate analytical solutions accurate up to quite close distances between cracks. Simple expressions for the effective elastic properties of a solid with any deterministic field of cracks are obtained; these expressions are asymptotically exact in the case of weak interactions and can be expected, on the other hand, to yield accurate results at high crack densities.

12062 (CONF-8710218—1) **Low-cost, compact dilution refrigerator for particle detector applications.** Gray, K.E.; Roach, P.R.; Guschwan, W.D. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002961/JAW.

From International workshop on superconductive particle detectors; Torino, Italy (26 Oct 1987).

We have developed a one-shot ^{3}He-^{4}He dilution refrigerator using charcoal pumps that is of a very compact and simple design (essentially portable) and eliminates many of the problem areas of continuously operating refrigerators. It will cool below 0.015 K and run at this temperature for more than 10 hours. It is likely that a typical user would make whatever measurements were desired during the 10 hour running time at low temperature and then let the system recycle automatically overnight. For operation at higher temperatures, the running time is expected to be considerably longer. This refrigerator would also be ideally suited for particle detector applications requiring temperatures below 300 mK. With computer control, the refrigerator can be run relatively unattended, except for replenishing the liquid ^{4}He bath, for indefinite periods of time by persons with little or no expertise with dilution refrigerators, and at considerably less expense (and maintenance) than conventional systems. Thus the inherent low noise accompanying very low temperature operation can be available to everyone. 5 figs.

12063 (CONF-8710218—2) **Nonequilibrium superconductivity for particle detectors.** Gray, K.E. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03. Order Number DE88002876/JAW.

From International workshop on superconductive particle detectors; Torino, Italy (26 Oct 1987).

A considerable amount of attention has been devoted to nonequilibrium superconductivity over the last 10 to 15 years. A fairly complete and quantatitive understanding of the experimental and theoretical aspects of the subject has emerged. In this paper aspects of nonequilibrium superconductivity which are relevant to a majority of particle detector applications will be reviewed, and new calculations, more specific to actual detector applications, will be presented. The primary focus is on ionizing particles for which the characteristic energy is greater than typical superconducting energy gap values, Δ, of about 1 MeV. Thus microwave and far-infrared detection is excluded, although many of the results and consequences may also apply in those cases. 36 refs., 1 fig.

12064 (CONF-8710227—1) **Generic casting modeling.** Sha, W.T. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002940/JAW.

From International solar specialists' meeting on processing science; Cesme, Turkey (4 Oct 1987).

Although the casting process has been used for hundreds of years, it involves a host of complex phenomena that are still not thoroughly understood. To date, casting remains a highly empirical technology, and production of new castings requires an expensive, time-consuming, trial-and-error approach. The dominant phenomena are fluid motion and heat transfer, which control the quality of the final product - grain size and shape, porosity, and segregation of alloying elements. In recent years, mathematical modeling of casting has received increasing attention; however, a majority of the modeling work has been in the areas of heat transfer, solidification, metallurgical phenomena, and stress/deformation analyses. Very little work has been done in modeling fluid flow of the liquid melt. This paper presents a detailed model of fluid flow coupled with heat transfer of a liquid melt for casting processes. The model to be described in this paper is an extension of the COMMIX code and is capable of handling castings of any shape, size, and material. While much of the emphasis in this paper is placed on fluid flow and heat transfer, a brief mention of R & D needs in modeling of metallurgical aspects, as well as stress/deformation is also outlined. A feature of this model is the ability to track the liquid/gas interface and liquid/solid interface. It can also calculate alloy element distributions providing that constitutive relations such as interfacial drag between alloy elements are available. The flow of liquid melt through the spruces, runners, and gates into the mold cavity is calculated, along with three-dimensional temperature and velocity distributions of the liquid melt throughout the casting process. 18 refs., 18 figs.

12065 (DOE/ER/13142—T1) **Research on fluid dynamic energy separation: Final technical report.** (George Washington Univ., Washington, DC (USA). School of Engineering and Applied Science). Jun 1987. Contract AS05-83ER13142. 13p. (GWU/SEAS-TR-ES—87-4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002776/JAW.

A study has been made of "fluid dynamic energy separation", an air conditioning and heating mechanism that has been found to promise important advantages of energy economy and mechanical simplicity. The fluid dynamic energy separator has only one moving part, a free spinning rotor. Air entering it is discharged through slanting orifices on its periphery, causing it to spin. The emerging air separates into hot and cold streams whose difference in temperature can be regulated as desired. The energy of the hot output is actually not in the form of heat but rather in the form of recoverable mechanical energy that, if not used for heating, may be utilized in the pressurization of supply air, thereby saving energy. 16 refs., 6 figs.

12066 (DOE/ER/13331—1) **A collaborative program of research in engineering sciences.** (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.; Idaho National Engineering Lab., Idaho Falls (USA)). Mar 1987. Contract FG02-85ER13331;AC06-87RL10930. 458p. NTIS, PC A20/MF A01; 1; GPO Dep. Order Number DE88003383/JAW.

This proposal describes a collaborative program of energy-related engineering research. The proposal builds upon, and ex-

tends, research begun in 1985. Research areas in the initial program were: thermal plasmas; automated welding; engineering analyses and design; and solid mechanics. Work in these areas will continue. New projects are proposed in the area of sensors and diagnostics. Each organization, MIT and INEL, will conduct research in each of the areas. The research projects are coordinated between institutions and are designed to enhance the productivity of the program by exploiting the separate strengths of each organization. The MIT segment of the program involves 18 faculty members, 8 professional staff members, and 31 graduate research assistants. The program is planned for a 5-year duration.

12067 **(HEDL-SA—3338-FP) Nuclear fuel assembly identification using computer vision.** Moffett, S.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 1 Aug 1985. Contract AC06-76FF02170. 4p. (CONF-8510112—2). NTIS, PC A02. Order Number DE86005482/JAW.

From American Nuclear Society winter meeting; San Francisco, CA, USA (10 Oct 1985).

A new method of identifying fuel assemblies has been developed. The method uses existing in-cell TV cameras to read the notch-coded handling sockets of Fast Flux Test Facility (FFTF) assemblies. A computer looks at the TV image, locates the notches, decodes the notch pattern, and produces the identification number. A TV camera is the only in-cell equipment required, thus avoiding complex mechanisms in the hot cell. Assemblies can be identified in any location where the handling socket is visible from the camera. Other advantages include low cost, rapid identification, low maintenance, and ease of use.

12068 **(INIS-mf—11076) Proceedings of the first international symposium on physical and technical problems of superconductivity application in power generation.** (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Elektrotechnicky Ustav). 1986. 225p. (In Russian). (CONF-8510484—). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700818/JAW.

From 1. international symposium on physical and technical problems of superconductivity application in power generation; Smolenice, Czechoslovakia (22 Oct 1985).

The proceedings contain the introductory speech of the representative of the Electrotechnical Institute of the Slovak Academy of Sciences, the text of recommendation adopted by the participants of the symposium, the symposium programme, and the full texts of 24 out of 39 papers submitted to the symposium. The papers published are classified into 5 topic areas, viz.: superconducting ac facilities; superconducting magnet systems; magnetic separation; superconducting materials; electromagnetic and thermal properties of superconductors. (A.K.) 100 figs., 29 tabs., 123 refs.

12069 **(KFK—4308) Assessment of potential advantages of high T/sub c/-superconductors for technical application of superconductivity.** Schauer, F.; Juengst, K.P.; Komarek, P.; Maurer, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). Sep 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88751943/JAW.

A first assessment of the technical and economical consequences of liquid nitrogen cooling of new superconductors is given. For the investigation the applications of superconductivity are classified in two categories: First, systems where superconductors are practically indispensable for achieving the system's objectives; second, superconductor applications in competition with highly developed conventional technologies. Further development of those superconducting systems in the first category for which the cost of cryogenic equipment is a smaller fraction of the total system cost (e.g. fusion reactor or MHD generator) will hardly be affected. However, for systems like particle accelerators, research magnets, and NMR spectroscopy and imaging systems, the cryogenic equipment expenditures are significant and LN/sub 2/ cooling leads here to a reduction of investment and operating costs, to simplified handling and maintenance, to better reliability and availability, and will thereby improve the acceptance and further spread of these systems. In the second category each application of superconductivity has to be compared with its conventional counterpart, separately. Here, electonic components, power switches, resistive current limiters, and especially the power transmission cables are those applications which look most promising. For magnet applications the main advantageous arguments are less the cost saving aspect but more the higher reliability, simplicity, N/sub 2/-availability, and ease of handling.

12070 **(LA—11164-MS) CW RFQ core-tank structure analyses.** Bradley, J. (Los Alamos National Lab., NM (USA)). Jan 1988. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003513/JAW.

Two- and three-dimensional analyses were run on the core tank of a 2-MeV, 100-mA CW RFQ structure being designed and built by Los Alamos National Laboratory and Culham Laboratory in England. The purposes of these analyses were to pinpoint initial values for parameters of the design to minimize tip displacement of the tank, to determine if a two-dimensional plane-strain analysis would adequately describe the behavior of the tank at midplane, and to study the end effects seen in the tank as a result of the temperature loading. It was discovered in this study that, for a water velocity of 5 m/s through the cooling channels, cooling-water temperatures of 10°C in the tip of the structure and 27.67°C in the skirt and base cooling-water channels produced a tip displacement well within acceptable tolerances. A two-dimensional plane-strain analysis produced results that compared very well with those seen in the midplane of the structure in the three-dimensional analysis. A very large end effect, or flaring of the tank, was observed in the structure. 31 figs., 2 tabs.

12071 **(LA-UR—87-3582) Experimental identification of nonlinear structural models.** Paez, T.L.; Hunter, N.F. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 24p. (CONF-880220—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001795/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

A fundamental objective of structural dynamic engineering is to understand the behavior of physical structures subjected to field environments. In practical situations, many structures execute nonlinear motions, and under the influence of extreme excitations structures often show strongly nonlinear responses. Recent investigations have shown that the Volterra model provides a means for system characterization that holds great potential for the description of nonlinear structural response. Simulations have shown that when the Volterra model of a structure is available, it can provide a reasonable match to numerically simulated nonlinear response. The present investigation considers the identification of the functions used in the Volterra model for physical structures tested in the laboratory. It is shown that the frequency form of the Volterra functions can be estimated directly using measured excitation and response data. A coherence-like measure of the observed structural response and the nonlinear model is developed, and it is shown that this quantity can be used to evaluate the accuracy of the nonlinear structural model. Finally, the characteristics of structures most suitably modelled by the Volterra series are discussed. 8 refs., 8 figs.

12072 **(LA-UR—87-3767) Pulsed laser stereophotography of plasmas and dynamically moving surfaces.** Paisley, D.L. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 6p. (CONF-8708110—27). NTIS, PC A02. Order Number DE88003170/JAW.

From 31. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA, USA (16 Aug 1987).

A pulsed laser is used as a light source for illuminating the surface of a dynamic event of ≤ 1 mm^2 moving at >3 mm/μs. At a predetermined time during the dynamic action, a stereo camera is used to record a pair of images of the dynamically moving surface. The stereoimage pair can be quantified for surface contour. 3 refs., 8 figs.

12073 **(OH/R—87/12/K) Delta-Omega stabilizer Bruce 'A' GS.** Beaulieu, R.E. (Ontario Hydro Research Div., Toronto (Canada)). 19 Feb 1987. vp. (MICROLOG—87-04884). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Power System Stabilizers based on the direct measurement of changes in turbine-generator shaft speed have been in service on the Bruce 'A' units since 1976. Recently, these stabilizers have been equipped with Transient Stability Excitation Control circuits and Dynamic Test Facilities. The old manual on these stabilizers has thus been superceded. This new edition covers the design, operation, maintenance procedures, and modelling of the Delta-Omega stabilizer and all the added features. 37 figs.

12074 **(ORNL—6419) A project to experimentally and theoretically examine fluid interfacial wave phenomena in a rotating cylindrical geometry: Current results and future plans.** Lawkins, W.F.; Thompson, S.; Sartory, W.K.; Gillies, G.T.; Ritter, R.C. (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003738/JAW.

A prototype of the new instrument for experimentally studying stratified fluid wave phenomena in a rotating cylindrical geometry, both of infinitesimal and nonlinear forms, has been designed, built, and partially characterized. Furthermore, a model for analyzing the use of control forces to eliminate infinitesimal instabilities from the fluid/mechanical system has been developed and used. Finally, a nonlinear model for analyzing forced interfacial waves has been defined and steps are currently being taken to implement that model. 28 refs., 50 figs., 7 tabs.

12075 **(PB—88-123682/XAB) Metrology for electromagnetic technology: a bibliography of NBS (National Bureau of Standards) publications, January 1970-December 1986.** Kline, K.E.; DeWeese-Bishop, M.E. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Technology Div.). Jun 1987. 62p. (NBSIR—87/3074). NTIS, PC A04/MF A01.

Supersedes PB—87-125738.

This bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through December 1986. A few earlier references that are directly related to the present work of the Division are included. Fields covered include the following: Optical electronic metrology, Cryoelectronic metrology, and Superconductor and magnetic measurements.

12076 **(PNL-SA—14137) Microcomputer analysis of regenerative heat exchangers for oscillating flow.** Hutchinson, R.A.; Lyke, S.E. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1987. Contract AC06-76RL01830. 9p. (CONF-870307—25). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001773/JAW.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

Regenerative heat exchangers for use in oscillating flows such as those occurring in Stirling engines present considerable analytical problems to the thermal engineer. A simplified finite element analysis has been implemented in a spreadsheet, providing improved access to analytical assumptions and allowing parametric analysis of current heat transfer data. In addition, an irreversibility analysis has been implemented using the thermal and friction results in the spreadsheet. It is suited for evaluation and insights into loss tradeoffs inside operating regenerators, to suggest new regenerator design concepts, and to focus experimental work. 22 refs., 13 figs.

12077 **(QU/P—83) Investigation of the effects of mechanical stress on the magnetic properties of pipelines steels for pipeline stress monitoring. Final report.** Atherton, D.L.; Jiles, D.C. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics). 1983. 157p. (MICROLOG—84-2236). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Anomlous stresses or changes in stresses may be detected by magnetometer survey. The present work provides basic data and understanding. The major achievements are the +evelopment of a unified theory of ferromagnetic hysteresis and an explanation of the apparently conflicting magnetization changes when steel is stressed. This theory states that the result of a mechanical stress cycle is to shift the magnetization towards the anhysteretic magnetization, which is also stress dependent. Experimental data is presented for three samples of pipeline steels. This is obtained in a special apparatus designed to stress small samples in an external magnetic field. Special instrumentation includes very low drift voltmeter/fluxmeter and strain gauge bridge and complete computer control and data logging of all experimental parameters such as stress and magnetic field. Special computer routines are used for sample demagnetization and for measuring the anhysteretic magnetization curve. Associated work on the effects of stress on magnetic inspection techniques for pipelines is reported. 40 figs.

12078 **(RFP—4141) Automated saturated standard cell intercomparison.** Bell, B.E.; Deitesfeld, C.A. (ed.). (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 5 Oct 1987. Contract AC04-76DP03533. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004494/JAW.

A cost effective, highly efficient, and automatic method of intercomparing standard cells has been sought after and implemented, utilizing computer control and a commercially available scanner. This system reduces intercomparison time from 4 hours to 30 minutes using the standard National Bureau of Standard (NBS) 4 x 4 design. 7 figs., 1 tab.

12079 **(SAND—87-1332C) An adaptive filtering technique for removing periodic noise from modal response data.** Tucker, M.D. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-880220—5). NTIS, PC A02. Order Number DE88002347/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

In many modal tests, the dynamic response of the system is contaminated with periodic noise from sources such as pumps and motors that is not correlated with the excitation used to derive the frequency response functions. This paper describes an adaptive filtering technique to remove this noise from the response time history data. The output of the filter is a signal which contains only the modal response of the system that is correlated with the input excitation force. In addition to the theory of this technique, practical examples are also presented to verify the method. 4 refs., 11 figs., 6 tabs.

12080 **(SAND—87-1619C) Frequency response function estimation at level.** Rodeman, R.; Davie, N.T. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1987. Contract AC04-76DP00789. 5p. (CONF-880220—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002644/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

A technique for determining structural frequency response functions at high excitation energy levels is described. The FRFs are obtained by firing long cylindrical bars into the structure of interest. The strain in the bar, which is easily measured, can be directly related to the force imparted to the structure. The FRFs are then obtained from relationships between the imparted force and the resulting accelerations in the structure. The method is simple to implement and the results obtained are repeatable. 3 refs., 7 figs.

12081 **(SAND—87-1634C) Qualification of frequency response functions using the rigid-body response.** Smallwood, D.O.; Lauffer, J.P. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-880220—1). NTIS, PC A02. Order Number DE88000745/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

The response of a structure at low frequencies with free boundary conditions is dominated by the rigid-body modes. The displacement shapes obtained from the low frequency values of the frequency response functions can be compared with ideal rigid-body motion to point out errors in the measurements. Insight is enhanced when the comparisons are made in the coordinate system of the measurements. Without this procedure intuition can rarely determine the proper rigid-body response at each measurement location. Typical errors identified are scaling errors, errors in location or direction, measurements with poor dynamic range and other instrumentation problems. The procedure is particularly useful when the test object is multidimensional, has a complicated geometry, has measurements in other than rectangular coordinates, and where more than one rigid-body mode is excited. It is suggested that data qualification using this method would be a useful addition to most modal tests. A least squares approach, to determine the proper rigid-body response, is reviewed and several experimental examples are given. 4 refs., 12 figs.

12082 **(SAND—87-2215) A hybrid transform/DPCM encoder for data compression.** Gray, S.D. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003725/JAW.

A new technique for the transmission of video is presented in this paper. It incorporates several ideas that enable a significant reduction in the data rate over a straightforward pulse code modulation (PCM) system. Theoretical expressions are presented to give a firm background in how the procedure works and what are its limitations. Although the proposed system contains a considerable amount of computational sophistication, an emphasis has been placed on portable applications. To back up these ideas and allow the reader to judge the effectiveness of this procedure, several photographs are included. 6 refs., 3 figs., 3 tabs.

12083 **(SAND—87-2567C) Strategic placement of accelerometers to measure forces by the sum of weighted accelerations.** Priddy, T.G.; Gregory, D.L.; Coleman, R.G. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 28p. (CONF-880220—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002262/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

A force identification method using a sum of weighted accelerations (SWA) has recently been demonstrated. Accuracy of the SWA method depends on the number and the placement of the accelerometers and the selection of the best set of weighting factors. Procedures have been proposed for determining the number of accelerometers required for a given frequency bandwidth and an experimental-analytical method has been derived to calculate the optimum set of weighting coefficients. A procedural method is described and demonstrated in this paper for determining the placement of gages using results from a free-body modal characterization. Our proposed procedure is to place accelerometers at the nodes of the highest free-body vibrational mode in the frequency bandwidth of interest. All modes below this mode are well represented in the acceleration measurements. The weighting factors can be determined by the previously reported methods or according to a theoretical method introduced in this paper. The present method satisfies the objective of "zeroing-out" the contribution of free-body vibration modes in the SWA method of force identification. We illustrate the theory through the analysis of a simple beam, and we then demonstrate the procedure with the laboratory testing of a softly suspended aluminum beam. 3 refs., 15 figs., 2 tabs.

12084 **(SAND—87-8216) A fiber-optic link for pressure control of ion sources.** Black, K.L.; Macmillan, D.C.; Bastasz, R. (Sandia National Labs., Livermore, CA (USA)). Aug 1987. Contract AC04-76DR00789. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001782/JAW.

A fiber-optic link providing high-voltage electrical isolation of pressure gauging and control instrumentation associated with a Colutron ion source has been developed. The link transmitter is connected to the control circuitry and is kept at ground potential. The link receiver/modulator is battery operated and attached to a piezoelectric valve located on the ion source, all of which can be biased up to 5 kV. Feedback signals sent via the link control the valve so that constant pressure in the ion source is maintained. The link is simple, compact, and enhances ion source stability and ease of operation. 7 figs.

12085 **(UCID—21265) LLNL Superconducting Magnet Development Program: Final report, fiscal year 1987.** Miller, J.R.; Chaplin, M.R.; Kerns, J.A.; Rosdahl, A.R.; Slack, D.S.; Strum, M.J.; Summers, L.T. (Lawrence Livermore National Lab., CA (USA)). 30 Nov 1987. Contract W-7405-ENG-48. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004066/JAW.

We report the progress of the LLNL Superconducting Magnet Development Program for the fiscal year 1987. The report is organized according to the following working areas: Conductor Development and Characterization; Coil Winding Technology Development, Materials Development and Characterization; Cryogenic Systems Development; Coil Engineering, Design, and Analysis; Facility Maintenance and Operation; and Program Administration and Technology Transfer. The highlights of this year's activity have been the completion of the upgrade of the HFTF cryogenic system, completion of the first round of Lorentz force tests of cable-in-conduit conductors, significant progress on the upgrade of the HFTF helium recovery system, and significant progress in the development and procurement of internal-tin process, Nb_3Sn superconductor for our 0.3-m o.d. insert. 11 figs., 6 tabs.

12086 **(UCRL—53817) A control system for maintaining high stability in gas pressure.** Wuest, C.R.; Hendricks, C.D. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003712/JAW.

A pressure control system has been implemented on an experiment designed to detect the presence of fractional charges in bulk matter. The experiment utilizes a liquid-droplet generation technique requiring high-stability gas-pressure delivery to ensure accurate data collection. The pressure control system consists of a pressurized mercury reservoir containing a low-vapor-pressure, diffusion-pump oil. A commercially available differential pressure transducer, servo-driven valve, and controller sense the pressure fluctuations with respect to a static reference pressure. The system can maintain constant pressure to better than one part in 10,000 at working pressures in the range of 100 to 300 psi. 3 refs., 7 figs.

12087 **Performance evaluation of nuclear grade filters for the Trupact-I pressure equalization system.** Sandoval, R.P.; Joseph, B.J. (Transportation Technology Center, Sandia National Labs., Albuquerque, NM). *Journal of Nuclear Materials Management;* 16: 134-135(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The performance of high-efficiency-particulate-air and ultra-low- penetration-air filters subjected to extreme environments of temperature, shock, pressure, and particulate loading was evaluated in a test program at the Sandia National Laboratories. The test program was initiated to evaluate the feasibility of using commercially available nuclear-grade filters in the filtered pressure equalization system of a contact-handled transuranic waste transport system, called TRUPACT-I. The filtered pressure equalization system of TRUPACT-I assures containment of the activity within the limits permitted by federal regulations and simultaneously equalizes the pressure between the cavity of the packaging and the environment,

and minimizes the buildup of radiolytically generated gases. The filters were exposed to temperatures, pressures and stresses that exceed expected environments in normal and accident conditions of transport. The performance of the test filters was determined by measuring and quantifying filter efficiency and the Darcy constant. In addition, the integrity of the filter housing was evaluated using non-destructive helium leak testing. The details of the test program and results obtained from the tests are presented in this paper.

12088 **Benchmarking computer codes for cask development.** Glass, R.E. (Transportation Systems Technology and Analysis Div., Sandia National Labs., Albuquerque, NM 87185). *Journal of Nuclear Materials Management;* 16: 125-128(Jul 1987). (CONF-870713—). Contract AC04-76DP00789.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Sandia National Laboratories has taken the lead in developing a series of standard problems to evaluate structural and thermal computer codes used in the development of nuclear materials packagings for the United States Department of Energy (DOE). These problems were designed to simulate the hypothetical accident conditions given in Title 10 of the Code of Federal Regulation, Part 71 (10CFR71) while retaining simple geometries. This problem set exercises the ability of the codes to model pertinent physical phenomena without requiring extensive use of computer resources. The development of the standard problem set has involved both national and international consensus groups. Nationally, both the problems and consensus solutions have been developed and discussed at Industry/Government Joint Thermal and Structural Code Information Exchange meetings. Internationally, the Organization for Economic Cooperation and Development (OECD), through its Nuclear Energy Agency's Committee on Reactor Physics, has hosted a series of Specialists' Meetings on Heat Transfer to develop standard thermal problems and solutions. Each of these activities is represented in the standard problem set and the consensus solutions. This paper presents a brief overview of the structural and thermal problem sets.

12089 **Applying consensus standards to cask development.** Leatham, J.; Abbott, D.G.; Warrant, M.M. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID 83415). *Journal of Nuclear Materials Management;* 16: 119-124(Jul 1987). (CONF-870713—). Contract AC07-76ID01570.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Department of Energy's (DOE's) Office of Civilian Radioactive Waste Management is procuring cask systems for transporting commercial spent nuclear fuel and is encouraging development of innovative cask designs and materials to improve system efficiency. New designs and innovative materials require that consensus standards be established so that cask designers and regulators have criteria for determining acceptability. Recent DOE experience in certifying three spent fuel shipping casks, NUPAC-125B, TN-BRP, and TN-REG, is discussed. Certification of the NUPAC-125B was expedited because it was made of conventional American Society for Testing and Materials (ASTM) materials and complied with the American Society of Mechanical Engineers (ASME) Code and Nuclear Regulatory Commission Regulatory Guides. The TN-BRP and TN-REG cask designs are still being reviewed because baskets included in the casks are made of borated stainless steel, which has no ASTM Specification or ASME Code approval.

12090 **Materials issues in cask development.** Chapman, R.L.; Sorenson, K.B. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID 83415). *Journal of Nuclear Materials Management;* 16: 110-113(Jul 1987). (CONF-870713—). Contract AC07-76ID01570.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

The Department of Energy Office of Civilian Radioactive Waste Management (DOE-OCRWM) is chartered by Congress under the Nuclear Waste Policy Act (NWPA) to build a permanent repository for commercial spent nuclear fuel and to provide a supporting transportation system. The OCRWM-sponsored From-Reactor Cask Systems Acquisition Program is developing a family of casks suitable for transporting commercial spent fuel. Phase I of the program is in the process of procuring cask designs for further development and eventual licensing. New materials will probably be proposed for various components of the cask system. This paper identifies potential new materials as a function of their use in the cask (containment, shielding, etc). To the extent that the identified materials are new (not yet qualified for their intended application), this paper identifies probable technical issues and development efforts which may be required to qualify the materials for uses in transportation casks.

12091 **Application of life cycle cost analyses in evaluation of nuclear waste transportation system alternatives.** Boggs-Mayes, C.; Peterson, R.W.; Dippold, D.G.; Brentlinger, L.A. (US DOE-Chicago Operations Office). *Journal of Nuclear Materials Management;* 16: 104-109(Jul 1987). (CONF-870713—).

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

Nuclear waste transportation, an essential part of the DOE's overall waste management responsibilities, entails moving discharged spent fuel (SF) from various U.S. reactors to a geologic repository, possibly via a monitored retrievable storage facility. The SF will be moved in special transportation casks, designed to satisfy stringent transportation casks, designed to satisfy stringent performance criteria. Various cask designs, all satisfying the performance criteria but differing in certain other design features, will be considered for the transportation role. This paper discusses the use of life cycle cost (LCC) as an aid in choosing among basic cask design concepts, in evaluating specific cask design features, and in assessing certain transportation system operating alternatives. The LCC approach is illustrated through analyses of several examples representing competing cask design concepts, cask design features, and system operating options.

4203 Lasers

REFER ALSO TO CITATION(S) 12152, 12229, 12271, 13759

12092 **(AD-A—184800/1/XAB) Optically pumped mode-locked PbS(1-x)Se(x) lasers.** Vilhelmsson, K.; Valk, B.; Salour, M.M. (Tacan Aerospace Corp., Carlsbad, CA (USA)). 30 Mar 1987. 4p. NTIS, PC A02/MF A01.

Optically pumped semiconductor lasers with an external cavity have been operated throughout the visible, and into the near-infrared region of the wavelength spectrum up to 2 micrometers. The external cavity combines the attractive features of good beam quality with the possibility to make use of intracavity elements for wavelength tuning, polarization, and modulation. Furthermore, these lasers can be used in mode-locked operation, which allows generation of 1-10 ps pulses. This letter describes the first optically pumped semiconductor lasers with an external cavity that emit above 4 micrometers. The materials used in the experiment were PbS(1-x)Se(x) with x=0 and 0.3. Lasing between the cleaved facets of optically pumped lead salt materials was reported in a previous paper.

12093 **(AD-A—184824/1/XAB) Gamma-ray laser project. Quarterly technical progress report No. 1, 1 April-30 June 1987.** Collins, C.B. (Texas Univ., Richardson (USA). Center for Quantum Electronics and Applications). Jul 1987. 60p. (UTD-GRL—8701). NTIS, PC A04/MF A01.

Recent approaches to the problem of the gamma-ray laser have focused upon upconversion techniques in which metastable nuclei are pumped with long wavelength radiation. At the nuclear level the storage of energy can approach tera-Joules (10^{12} J) per liter for thousands of years. However, any plan to use such a resource for a gamma-ray laser poses problems of a broad interdisciplinary nature requiring the fusion of concepts taken from relatively unrelated fields of physics.

12094 **(AD-A—185059/3/XAB) Computer simulation of c-w HF chemical laser unstable resonator performance. Technical report.** Sentman, L.H.; Gilmore, J.O. (Illinois Univ., Urbana (USA). Dept. of Aeronautical and Astronautical Engineering). Aug 1987. 102p. (AAE—87-5). NTIS, PC A06/MF A01.

Inadequacies in the treatment of the fluid-dynamic mixing that were not apparent in Fabry-Perot or stable resonator models were revealed with a wave optics-unstable resonator model. The unstable resonator data as a function of resonator size and size of the laser were shown to provide a severe test of a couples, wave optics, chemical kinetic, fluid-dynamic model of a chemical laser. A mechanism for the observed time-dependent oscillations that occur on lines whose saturated gain does not fill the unstable resonator was proposed. According to the proposed mechanism, the time-dependent oscillations are the result of a competition between chemical pumping and radiative deactivation of upper laser levels of HF. The oscillations occur only if the media is not strongly coupled to the optical fields diffractively or geometrically. Computer calculations supported the proposed mechanism and new unstable resonator experiments were suggested.

12095 **(AD-A—185099/9/XAB) Nonconventional optical techniques for optical-wavefront processing. Final report, June 1985-July 1986.** Salour, M.M. (Tacan Aerospace Corp., Carlsbad, CA (USA)). Jun 1987. 42p. NTIS, PC A03/MF A01.

This report describes the design and construction of an optically pumped semiconductor laser oscillator with the following specifications: 1) Operating wavelengths, 414 nm and 680nm, interchangeable (i.e., requires a change in optical setup and the pump source, but no change in the cavity design); 2) CW power, nominal 30 mW each line; and 3) Tuning range of + or - 30 nm. The laser includes all external ring-cavity components, cooling (nonliquid N2), and provisions were made for mounting line narrowing and tuning elements. Ancillary equipment list, operating and instruction manuals were also provided.

12096 **(AD-A—185155/9/XAB) Phase-locked semiconductor quantum-well laser arrays. Doctoral thesis.** Towe, E. (Massachusetts Inst. of Tech., Cambridge (USA). Research Lab. of Electronics). Mar 1987. 192p. (TR—526). NTIS, PC A09/MF A01.

This dissertation presents the experimental study of quantum-well heterostructures in the III-V compound semiconductor system of (Al,Ga)As/GaAs. This study was conducted with a view to applying these structures in heterostructure lasers; specifically, phase-locked laser arrays. Broad-area lasers fabricated from the quantum-well microstructures exhibited threshold current densities as low as 200 Amp/sq. cm. The major contribution of this work is a new monolithic laser array structure that achieves phase-locking through coupling by diffraction in a central mode-mixing region where the light is unguided. The propagating eigenmodes are index-guided on either side of the mode-mixing region in parallel-element ridge waveguides. The new array displays narrow, single-lobe far-field patterns. The narrowest far-field pattern observed is 2° wide. An analytic model that explains the characteristics of the observed far-field patterns is presented. This model is developed from a premise with experimental basis.

12097 **(AD-A—185241/7/XAB) Experimental study of c-w HF chemical-laser amplifier performance and zero-power gain. Technical report.** Sentman, L.H.; Theodoropoulos, P.; Waldo, R.; Nguyen, T.; Snipes, R. (Illinois Univ., Urbana (USA). Dept. of Aeronautical and Astronautical Engineering). Aug 1987. 122p. (AAE-TR—87-6). NTIS, PC A06/MF A01.

The multiline and single-line amplifier performance of a two-channel Helios CL II laser was studied. Flow-channel aperturing of the input beam was found to cause a significant reduction in the measured amplification ratio. The absorption of the the multiline input beam by SF_6 was found to be negligible (<0.5%/cm). Maximum multiline and single-line amplification was obtained when the input beam was passed through the amplifier at the XC corresponding to maximum zero-power gain. Single-line amplification ratios were considerably lower than multiline amplification ratios obtained for the same input power. The P2(6) amplification ratios were lower than the P1(6) amplification ratios, even though the P2(6) zero-power gain was considerably higher than the P1(6) zero-power gain. The data suggested that about 1/3 of the oscillator output needs to be input to obtain amplifier output equal to the device's oscillator performance.

12098 **(AD-A—185316/7/XAB) Core-excited metastable levels: application to spectroscopy, to the generation of picosecond extreme-ultraviolet pulses, and to lasers.** Harris, S.E.; Young, J.F. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Apr 1987. 17p. NTIS, PC A03/MF A01.

Pub. in Jnl. of the Optical Society of America B, Vol. 4, No. 4, 547-562(Apr 1987).

The paper reviews both the properties and the applications of core-excited metastable atoms. The production of these atoms by microwave-pulsed hollow-cathode discharges, and laser-produced x rays is described. The authors discuss the application of these atoms to several new types of spectroscopy that allow autoionizing line widths as narrow as 0.1/cm to be measured. The application of these metastables to the generation of picosecond-time-scale soft-x-ray pulses and to XUV lasers is also discussed.

12099 **(AD-A—185442/1/XAB) Phenomena at a focus in a laser system. Final report.** Reiss, H.R. (Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab.). 31 Jul 1987. 17p. (NSWC-TR—87-184). NTIS, PC A03/MF A01.

A high-powered, continuous-beam laser system is examined in terms of the physical conditions that exist if the laser beam is brought to a diffraction-limited, real focus in a moderate-vacuum environment. Ionization of the gas at the focus by multiphoton processes is extensive, but it is shown that neither reflection of the beam by the plasma at the focus nor absorption by ionization is sufficient to disrupt propagation of the beam through the focus.

12100 **(CEA-CONF—9051) Effect of beam power on the characteristics of a YAG laser welding head.** Aubert, P.; Bouilly, P.; Gascoin, J.Y.; Juguet, Y.; Crettiez, A. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). May 1987. 7p. (CONF-8705130—2). NTIS (US Sales Only), PC A02. Order Number DE88751486/JAW.

From International conference on laser advanced materials processing: science and applications; Osaka, Japan (21 May 1987).

The welding behaviour of 100 W and 200 W YAG lasers are different. The divergence increasing with the pumping power has needed a resonator modelling to establish the stability ranges and divergence values. Two systems of energy distribution measuring are presented.

12101 **(CEA-R—5400) Dye lasers: physical and chemical parameters.** Meyer, M.; Mialocq, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). Jun 1987. 50p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751485/JAW.

The first part of this report deals with the incidence of the linear and non linear refraction index variations upon the functioning of a dye laser. The linear component is related to the temperature whereas the non linear part of the refraction index depends on the laser pulse intensity. In the second part, we report upon the influence of the dye solvation and that of additives, as for example triplet quenchers, on the output of dye lasers. Problems of dye photobleaching are emphasized.

12102 **(LA-UR—87-3964) Conceptual designs of a 50 nm FEL [free-electron laser] oscillator and a 20-40 nm SASE [self-amplified spontaneous emission] amplifier.** Goldstein, J.C.; McVey, B.D.; Elliott, C.J. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 20p. (CONF-8709110—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003150/JAW.

From 9. international free-electron laser conference; Williamsburg, VA, USA (14 Sep 1987).

This paper consists of two parts: the conceptual design and optical performance characteristics of a grazing angle-of-incidence ring resonator utilizing multifaceted metal mirrors for use with a 50 nm rf-linac-driven XUV FEL oscillator; and electron beam and wiggler requirements for a self-amplified spontaneous emission (SASE) amplifier to produce high power in the 20 to 40 nm wavelength range. The basis for these studies is the 3-d FEL simulation code FELEX which is used to derive tolerances on mirror figure and thermal distortion, alignment sensitivity, and alternative output coupling methods. The sensitivity of the output characteristics of an XUV FEL SASE amplifier to wiggler field errors is also studied. 17 refs., 8 figs., 2 tabs.

12103 **(N—88-10331) Diode pumped solid-state laser oscillators for spectroscopic applications.** Byer, R.L.; Basu, S.; Fan, T.Y.; Kozlovsky, W.J.; Nabors, C.D.; Nilsson, A.; Huber, G. (Stanford Univ., CA (USA)). 1987. 7p. (NASA-CR—180576; NAS—1.26:180576). NTIS, PC A02/MF A01.

The rapid improvement in diode laser pump sources has led to the recent progress in diode laser pumped solid state lasers. To date, electrical efficiencies of greater than 10 percent were demonstrated. As diode laser costs decrease with increased production volume, diode laser and diode laser array pumped solid state lasers will replace the traditional flashlamp pumped Nd:YAG laser sources. The use of laser diode array pumping of slab geometry lasers will allow efficient, high peak and average power solid state laser sources to be developed. Perhaps the greatest impact of diode laser pumped solid state lasers will be in spectroscopic applications of miniature, monolithic devices. Single-stripe diode-pumped operation of a continuous-wave 946 nm Nd:YAG laser with less than 10 m/w threshold was demonstrated. A slope efficiency of 16 percent near threshold was shown with a projected slope efficiency well above a threshold of 34 percent based on results under Rhodamine 6G dye-laser pumping. Nonlinear crystals for second-harmonic generation of this source were evaluated. The $KNbO_3$ and periodically poled $LiNbO_3$ appear to be the most promising.

12104 **(N—88-10332) High energy efficient solid state laser sources. Semiannual progress report, period ending 30 September 1987.** Byer, R.L. (Stanford Univ., CA (USA)). Nov 1987. 8p. (NASA-CR—181362; NAS—1.26:181362). NTIS, PC A02/MF A01.

Investigations continue of diode-laser-pumped solid-state laser oscillators and nonlinear processes using them as sources. Diode laser array pumped Nd:YAG and Nd:glass lasers have been demonstrated. Theoretical studies of non-planar oscillators have been advanced, producing new designs which should be more resistant to feedback and offer better frequency stability. A monolithic, singly resonant Optical Parametric Oscillator in $MgO:LiNbO_3$ has been operated.

12105 **(PB—88-109988/XAB) Bibliometric survey of laser research in Sweden, West Germany, and Japan. Discussion paper.** Granberg, A. (Lund Univ. (Sweden). Research Policy Inst.). 1986. 42p. (DP—172). NTIS, PC E05/MF E05.

This study presents a comparative outline, based on output data, of the development efforts of Sweden, West Germany, and Japan in the field of laser technology. The bibliographic material has been compiled and analyzed in an attempt to estimate: (i) the relative magnitude and overall dynamics of the national R&D efforts in laser technology; (ii) the relative involvement, in these efforts, of different sectors of the national R&D systems; and (iii) the relative prominence of individual institutional actors as contributors to the national output. Apart from its substantive aim, the study also purports to explore and illustrate the possibilities and limitations of bibliographic data-base searchers in the larger methodological context of the three-country project. The reader will find in the report, first, a background sketch of laser technology, followed by a brief description of the sources of information and methods of data collection used in the survey. The results obtained are then presented - verbally and in a series of diagrams and tables and commented upon.

12106 **Promethium-doped phosphate glass laser at 933 and 1098 nm.** Krupke, W.F.; Shinn, M.D.; Kirchoff, T.A.; Finch, C.B.; Boatner, L.A. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Applied Physics Letters;* 51: No. 26, 2186-2188(28 Dec 1987). Contract W-7405-ENG-48;AC05-84OR21400.

A promethium (Pm^{3+}) laser has been demonstrated for the first time. Trivalent promethium 147 doped into a lead-indium-phosphate glass etalon was used to produce room-temperature four-level laser emission at wavelengths of 933 and 1098 nm. Spectroscopic and kinetic measurements have shown that Pm^{3+} is similar to Nd^{3+} as a laser active ion.

12107 **Dynamics of collisional excitation x-ray lasers.** Rosen, M.D.; Trebes, J.E.; MacGowan, B.J.; Hagelstein, P.L.; London, R.A.; Matthews, D.L.; Nilson, D.G.; Phillips, T.W.; Whelan, D.A.; Charatis, G. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* 59: No. 20, 2283-2286(16 Nov 1987). Contract W-7405-ENG-48.

We present absolutely timed spectral measurements, as well as other data, on the exploding-foil Ne-like Se soft—x-ray laser scheme. The data show that amplification occurs near the peak of the optical heating pulse, in agreement with our original theoretical predictions. A recently published alternative scenario predicted that gain develops only after the heating pulse, via recombination in an overionized, rapidly cooling plasma. Since our new data differ so sharply from that prediction, we reexamine the theoretical basis for that alternative scenario.

12108 **Stimulated emission in optically pumped atomic-copper vapor.** Jin Joong Kim; Nackchin Sung. (Center for High Technology Materials and Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, New Mexico 87131). *Optics Letters;* 12: No. 11, 885-887(Nov 1987).

We have observed, for the first time to our knowledge, stimulated emission in atomic-copper vapor that is excited by a resonant tunable laser beam. One of the important and interesting results obtained in this experiment is that excitation of the $^2P/sub\ 1/2/$ level of the copper atoms generates strong amplified spontaneous emission (ASE) for both $^2P/sub\ 1/2/—^2D/sub\ 3/2/$ and $^2P/sub\ 3/2/—^2D/sub\ 5/2/$ transitions. This is the first reported direct experimental evidence observed for collisional mixing between the $^2P/sub\ 1/2/$ and $^2P/sub\ 3/2/$ levels in a copper-vapor laser. Excitation of the $^2P/sub\ 3/2/$ level induces substantially weaker ASE for the $^2P/sub\ 1/2/—^2D/sub\ 3/2/$ transition. In addition, we observed collision-induced ASE for both transitions over a wide range of detuning of the pump frequency. The preliminary results of the experiment are presented, and the implications of the results for high-pressure copper-vapor lasers are discussed.

12109 **Saturation of the Xe III 109-nm laser using traveling-wave laser-produced-plasma excitation.** Sher, M.H.; Macklin, J.J.; Young, J.F.; Harris, S.E. (Edward L. Ginzton Laboratory, Stanford University, Stanford, California 94305). *Optics Letters;* 12: No. 11, 891-893(Nov 1987).

We describe the construction and operation of a 109-nm, photoionization-pumped, single-pass laser in Xe III. The laser is pumped by soft x rays emitted from a laser-produced plasma in a traveling-wave geometry. Using a 3.5-J, 300-psec, 1064-nm laser pump pulse, we measure a small-signal gain coefficient of 4.4 cm^{-1} and a total small-signal gain of exp(40). The laser is fully saturated and produces an output energy of 20 μJ in a beam with 10-mrad divergence.

12110 **Observation of super Coster—Kronig-pumped gain in Zn III.** Walker, D.J.; Barty, C.P.J.; Yin, G.Y.; Young, J.F.; Harris, S.E. (Edward L. Ginzton Laboratory, Stanford University, Stanford, California 94305). *Optics Letters;* 12: No. 11, 894-896(Nov 1987).

We report the observation of laser gain in the vacuum ultraviolet pumped by super Coster—Kronig decay. Using a 5-J, 300-psec pump pulse of 1064-nm radiation, we have observed gain on transitions in Zn III at 127.0, 130.6, and 131.9 nm with total gains

of exp(2.4), exp(5.1), and exp(3.2), respectively. The large branching ratios of the rapid super Coster—Kronig decay into a small number of final levels makes high-efficiency operation possible.

12111 **Shortening of KrF* laser pulses using stimulated Brillouin scattering.** McIntyre, I.A.; Boyer, K.; Rhodes, C.K. (Laboratory for Atomic, Molecular, and Radiation Physics, Department of Physics, P.O. Box 4348, Chicago, Illinois 60680). *Optics Letters;* **12**: No. 11, 909-911(Nov 1987).

Pulses as short as 43 psec were generated by Brillouin backscattering at 248 nm in cyclohexane. The measurements show that the process is accompanied by considerable spectral broadening of the reflected radiation.

12112 **Controlled scanning of a continuous-wave dye laser with an intracavity photorefractive element.** Ramsey, J.M.; Whitten, W.B. (Analytical Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6142). *Optics Letters;* **12**: No. 11, 915-917(Nov 1987). Contract AC05-84OR21400.

An intracavity photorefractive crystal is used in a cw dye laser. The frequency selection of the grating written in the crystal by the laser's standing-wave intensity pattern reduces the laser spectrum to a pair of hole-burning modes. The wavelength can be tuned by varying the laser-cavity length. Wavelength scans across an entire gain curve are possible without mode hops.

12113 **Multilayer structures and laboratory X-ray laser research; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986.** Ceglio, N.M.; Dhez, P. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1987). 243p. (CONF-860880—).

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

Papers are presented on X-ray laser research; soft X-ray amplification by Li-like ions in recombining plasmas; time- and space-resolved spectroscopy of X-ray laser experiments from 81 to 220 A; X-ray laser cavity experiments; and measurements on a proposed short wavelength laser system in Xe III. Consideration is given to the characterization of multilayer structures for soft X-ray laser research; TEM and X-ray analysis of multilayer mirrors and beamsplitters; the fabrication and evaluation of Mo-Si multilayer mirrors for soft X-ray; damage to multilayer mirrors in a hostile environment; the design and fabrication of heat resistant multilayers; Si diffraction gratings for multilayer structures; a Schwarzschild microscope for studying the preheat of laser heated targets; and the use of kinetic ellipsometry as a control system for ultrathin-layer stacks growth. The design and application for X-ray CCD cameras and a performance model for a CCD X-ray detector are discussed.

12114 **Multilayer structures and laboratory x-ray laser research: SPIE volume 688.** Ceglio, N.M.; Dhez, P. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1987). 243p. SPIE Society of Photo-Optical Instrumentation Engineers, 1022 19 St., P.O. Box 10, Bellingham, WA 98227.

This book's contents are divided into five sessions. Papers are presented under the following topics: X-ray lasers I; X-ray laser research at the Rutherford Appleton Laboratory; X-ray lasers II. X-ray laser cavity experiments; Multilayer structures I; Multilayer structures II; and X-ray imaging CCD.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 10674, 11748, 11753, 12050

12115 **(AD-A—184963/7/XAB) Nonlinear hyperbolic conservation laws. Technical report (Final), 1 October 1985-31 May 1987.** Shearer, M. (North Carolina State Univ., Raleigh (USA). Dept. of Mathematics). 17 Aug 1987. 6p. NTIS, PC A02/MF A01.

The focus of this research project has been the study of systems of conservation laws that lose strict hyperbolicity. Two areas of application, namely isentropic gas dynamics for a van der Waals gas, and multiphase flow in a porous medium were considered. Additionally, a numerical study of the elastic string equations using Glimm's random-choice method has been completed.

12116 **(CNIC—00043) Development of liquid helium storage dewar of the multishield thermal insulation type.** Zeng Fanan; He Ji. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 7p. (In Chinese). (SIP—0022). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700954/JAW.

The Dewar with multishield thermal insulation structure has been developed. The inner vessel is suspended with neck tube and there are no other thermal conducting channels. The suspension structure is sealed with the bellows and supported by a movable spherical bezel. Thus the previous drawbacks of outbreak due to the direct welding and shock force are avoided.

12117 **(CONF-871234—2) A review of flow-induced vibration in two-phase flow.** Chen, S.S. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02. Order Number DE88002873/JAW.

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

Based on the homogeneous two-phase flow model and theory of elasticity, the dynamic fluid/structure interaction can be described by the same equation as that for single phase flow. Based on the direction of flow with respect to the major axis of structural components, two-phase flow-induced vibration problems can be divided into two groups: axial flow in which the flow direction is parallel to the structural axis and crossflow in which the flow direction is perpendicular to the structural axis. Both axial-flow and crossflow-induced vibrations have been studied in past decades. In this note, a review of two-phase flow-induced vibrations is presented for crossflow as well as axial flow. The objectives are to summarize the excitation mechanisms, mathematical models, response characteristics, design considerations and future research needs. 44 refs.

12118 (CONF-8706187—, pp 100-108) **Visualization techniques for understanding particle dispersion in turbulent shear flows.** Troutt, T.R.; Hanle, R.; Kamalu, N.; Wen, F.; Chung, J.N. (Washington State Univ., Pullman). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

This research program is directed towards understanding the role of quasi deterministic large scale vortices in the dispersion of particles by free turbulent shear layers. The primary objective of this experimental study is to determine the influence and importance of these vortex structures on the particle dispersion process over a range of particle and flow parameters. It has been hypothesized that if the time scale associated with the vortex motion and the particle relaxation time are of the same order, significantly enhanced particle dispersion may occur.

12119 (CONF-8706187—, pp 109-114) **Stability of thin films.** Bankoff, S.G.; Davis, S.H. (Northwestern Univ., Evanston, IL). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Static liquid layers on planar solid boundaries and their instabilities are discussed. The plates are heated and thermocapillary, evaporative and rupture instabilities are discussed with particular attention paid to the development of dry out. Long-wave evolution equations are derived that govern the nonlinear stability of the layers subject to the above coupled mechanisms. Previous theory, experiment and present results are thoroughly discussed.

12120 (CONF-8706187—, pp 115-122) **Experimental and theoretical studies of binary vapor condensation.** Frish, M.B.; Waterhouse, R.; Wilemski, G. (Physical Sciences Inc., Andover, MA). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Recent experimental research on the homogeneous nucleation and subsequent growth of binary clusters formed by adiabatically supercooling mixtures of condensible gases in a supersonic nozzle is discussed. The status of binary nucleation theory is also briefly reviewed.

12121 (CONF-8706187—, pp 209-217) **Chaotic advection: the efficient stirring of viscous liquids.** Aref, H.; Jones, S.W. (Univ. of California, San Diego). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

The theory of dynamical systems provides a useful framework for discussing the motion of passively advected particles by a flow. Particle orbits can be either regular or chaotic. The different regions of the flow, where one or the other of these possibilities is realized, can be identified by the construction of Poincare sections and the computation of Lyapunov exponents. Efficient stirring comes about by arranging flow control parameters such that many particle trajectories display large scale chaos. The kinematic origin of chaotic advection allows it to occur even in flows at very low Reynolds number. Results for three flow situations are discussed: the Stokes flow between eccentric, rotating cylinders; the advection by a pulsed source/sink system; and laminar flow in a twisted pipe.

12122 (CONF-8706187—, pp 218-225) **Mixing: stretching, breakup, and chaos.** Ottino, J.M. (Univ. of Massachusetts, Amherst). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

In spite of its universality and practical implications, the understanding of fluid mixing remains largely empirical and little theoretical foundation exists at the present time is summarized. Two closely related matters are discussed: (1) theoretical and experimental investigations of the conditions that determine the onset of chaos in deterministic two dimensional flows, and (2) studies of the dynamics of stretching and breakup of small droplets in such flows. Thus, (1) focuses on a global scale whereas (2) is a local analysis focusing on deformation and breakup in Lagrangian (linear) time dependent flows. The breakup depends in a complicated way on the balance between elongation and vorticity at small scales; on the other hand, the dispersion is effective if the large scale flow is chaotic. Much work remains to mesh the two levels; in this paper they elaborate on both aspects and indicate possible lines of attack for future studies.

12123 (CONF-8706187—, pp 226-235) **Comminution within particle beds.** Peterson, C.R. (Massachusetts Institute of Technology, Cambridge). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A four-part, analytical and experimental study of comminution within particle beds is described. Both single particle behavior and bed internal behavior are treated, for spherical particles. A 2-dimensional computer graphics simulation of bed behavior within moving boundaries is presented, including fragmentation of individual particles when specified failure criteria are met. Bed behavior may be described as the repeated build-up of internal, frictional, load-bearing structures, followed by major collapse triggered by the failure of one or a few key particles. The simulation is compared to experimental bed behavior with encouraging results. Particle failure is explored both experimentally and analytically, and it appears likely than an hydrostatic stress condition brought on by multiple contacts (yet to be explored) will be of major importance.

12124 (DFVLR-FB—87-25) **Calculation on film preparation and film motion of a swirl atomizer.** Schork, T.; Farago, Z. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). 1987. 81p. (In German). NTIS (US Sales Only), PC A05. Order Number DE88751230/JAW.

In this essay a concept of calculating basic hydraulic integral variables of a simplex swirl atomizer is introduced (as for example average mass flow, film thickness and the angle of the hollow conical sheet). The conservation both of angular and total momentum is assumed, the latter is described by the equation of Bernoulli assuming an inviscid vortex. For vortex flow, in addition to the conservation equations, a further criterium of stability is needed to get an unequivocal solution. Calculated results with different stability is needed to get an unequivocal solution. Calculated results with different stability criteria are compared to each other as well as to experimental data. The motion of the hollow conical sheet is calculated assuming an equilibrium between surface and inertia forces and using the time-average values of emergence mass flow and film thickness. Some possibilities are shown to improve the calculation for return flow swirl atomizers and to consider viscosity effects. With 34 figs., 2 tabs., 10 refs..

12125 (DOE/ER/13489—2) **An analysis of the closure conditions for two-fluid models of two-phase flow: Second year progress report for the period April 1, 1987-March 31, 1988.** Lahey, R.T. Jr.; Drew, D.A. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Dec 1987. Contract FG02-86ER13489. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003355/JAW.

During the second year of this three year research program considerable progress was made in our understanding of how to properly formulate two-fluid models of two-phase flow. The purpose of this report is to highlight the most significant findings made to date. Particular topics covered are: Sonic velocity and critical flow rate, void waves, and the second law of thermodynamics.

12126 (ENEA-RT-TERM—86-2) **Flow transients experiments with refrigerant-12.** Celata, G.P.; D'Annibale, F.; Farello, G.E.; Setaro, T.; Cumo, M. (ENEA, Casaccia, Italy. Centro Ricerche Energia; Rome Univ., Italy). (ENEA, Rome (Italy)). 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700994/JAW.

Flow transients have been investigated in a wide range of thermal-hydraulics situations with Refrigerannt-12. Six pressures (including the reference to PWR and BWR characteristic liquid to vapour densities ratios), several periods of the flowrate transients coastdown during the simulated flow decays, and different specific mass flowrate have been studied emploiyng a circular duct test section (Dsub(i)=7,5 mm). Two heated lengths of the test section have been considered (L = 2300 and 1180 mm). Experimental data have shown the complete inadequacy of steady-state critical heat flux correlations in predicting the onset of boiling crisis during fast flow transients (half-flow decay time, tsub(h)lt5.0-6.0 s). The flow transient does not show dependence, in terms of DNB conditions ,upon the length of the test section: the ratio between transient and steady-state critical mass flowrate is not dependent on the tested geometry. The time interval from the start of the flowrate transient to the onset of DNB (time to crisis), has been experimentally determined for all the runs. Data analysis for a better theoretical prediction of the phenomenon has been accomplished, and a design correlation for DNB conditons and time to crisis prediction has been proposed.

12127 (ENEA-RT-TERM—86-3) **Direct contact condensation of superheated steam on water.** Celata, G.P.; Farello, G.E.; Focardi, G. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1986. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700995/JAW.

Referring to the interaction of superheated steam (practically stagnant) with subcooled water (slowly moving) the results of an experimental research are presented and discussed. The investigated ranges of the main parameters are: system pressure, p up to 6 bar; inlet superheated steam temperature, Tsub(vsh) up to 225 degrees centigrade; saturated steam temperature, Tsub(sat) up to 155 degrees centigrade; inlet water temperature, Tsub(i) 20 and70 degrees centigra de; inlet water mass flowrate, Wsub(i) up to 35 g/s. As foreseen in a theoretical investigation, the total thermal power (and consequently the total heat transfer coefficient) does not show an appreciable dependence on superheated steam temperature, so it can be pratically evaluated by means of available correlations for saturated steam conditions. The direct contact condensation heat

transfer coefficient is linked to the overall one and is slightly dependent on the steam superheating degree, as experimentally confirmed.Experimental data concerning condensation and total heat transfer coefficient, together with the total thermal power transferred from the superheated steam to the liquid have been compared with those computed by means of a theoretical model proposed by the authors /15/: the agreement is acceptable (+-20%), well within the experimental accuracy. The work has been performed in the frame of the Safety Research Project, ENEA-TERM/RISIL. 15 refs.

12128 **(INIS-mf—11056) New airfoil sections for straight bladed turbine.** Boumaza, B. (Haut Commissariat a la Recherche, Algiers (Algeria). Centre d'Etudes Nucleaires et Solaires). Jul 1987. 88p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701075/JAW.

A theoretical investigation of aerodynamic performance for vertical axis Darrieus wind turbine with new airfoils sections is carried out. The blade section aerodynamics characteristics are determined from turbomachines cascade model. The model is also adapted to the vertical Darrieus turbine for the performance prediction of the machine. In order to choose appropriate value of zero-lift-drag coefficient in calculation, an analytical expression is introduced as function of chord-radius ratio and Reynolds numbers. New airfoils sections are proposed and analyzed for straight-bladed turbine.

12129 **(LSTM—32/T/83) Wall reattaching flow over two-dimensional obstacles and preliminary scanning of the flowfield with laser Doppler anemometry. Review.** Durst, F.; Founti, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik). 1983. 41p. NTIS (US Sales Only), PC A03. Order Number DE88751000/JAW.

The aim of this paper is to review the experimental and computational results on the reattaching flow over two- and three-dimensional obstacles in channels. The flow is extensively compared to that over two-dimensional backward-facing steps, which is considered as the simplest and most widely studied and understood wall-reattaching flow. The differences and similarities of these two flows are assessed and are used as guidelines for the present review purposes. The contributions relating to the obstacle flow are divided here to experimental and computational. They both interact since the latter use the findings of the former to check the efficiency of reproducing the physical characteristics via numerical methods. So, and in this sense, the features and governing parameters of obstacle flows are categorised according to the geometry of the obstacle and the pertaining boundary conditions. The experimental data are evaluated both with respect to their adequacy for computational purposes and in order to clarify the physical understanding of the flow. Then, the theoretical contributions are reviewed and the use of specific discretization schemes and turbulence models is assessed. The review closes with suggestions on the particularities of these flows that need further clarification. The last part of this report presents experimental data obtained at LSTM in order to scan the flowfield over a thin fence in a two-dimensional channel. The results cover Reynolds numbers from the laminar to transition and finally fully-turbulent regimes and are presented here for three fence heights corresponding to 25%, 50% and 75% of the channel height. The experimental results presented here aim at scanning the flowfield and hence quantifying the range of reattachment lengths and turbulence intensities expected. Detailed measurements are currently in progress to confirm the preliminary results and also to clarify certain aspects of the flow.

12130 **(LSTM—53/E/84) Piston-driven, unsteady separation at a sudden expansion in a tube: Flow visualization and LDA-measurements.** Durst, F.; Maxworthy, T.; Pereira, J.C.F. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik). 1984. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751001/JAW.

Flow visualization studies and LDA-measurements were performed of the flow field generated at a sudden expansion in a cylindrical pipe during the intake stroke of a piston. The range of piston Reynolds numbers investigated were 18 to 125 and covered the laminar and transition-to-turbulence regimes. A detailed study of the parameters influencing the structure of the flow, i.e. the clearance volume and the piston velocity, was carried out and is presented, and the mechanism for the creation of flow instabilities at low Reynolds numbers is outlined. The effect of flow Reynolds number was found to be small while the magnitude of the initial clearance volume was very important and controlled the qualitation features of the flow in the otherwise invariant geometry. Qualitative comparisons are given of the streamline patterns found from the flow visualization studies and from integration of the experimental velocity field measured by laser-Doppler-anemometry. These data can be used to compare various computational schemes proposed to numerically study problems of this type.

12131 **(LSTM—57/N/84) Two-phase flow predictions.** Arnal, M.; Boerner, T.; Durst, F.; Zeisel, H. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik). 1984. 80p. (CONF-8405441—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751003/JAW.

From Workshop on two-phase flow predictions; Erlangen, F.R. Germany (23 May 1984).

The workshop began with summaries of five different prediction procedures. Presentations were made by D. Milojevic, D. Wennerberg, B. Schoenung, A. Berlemont and M. Arnal. Along with the summaries, brief descriptions of the goals and applications of the various procedures were presented. Following the presentations, a detailed evaluation was made of the Eulerian scheme used by B. Schoenung and the Lagrangian schemes employed by D. Wennerberg and D. Milojevic. The three predictive programs were applied to test cases consisting of steady flows through a sudden expansion and the converged solutions were compared. Special attention was given to the profiles of the particle velocity, fluid velocity and void fraction. These comparisons as well as the presentations which preceded them were the starting points for the afternoon discussion sessions. Such things as the relative merits of the Lagrangian and Eulerian approaches as well as the following topics: Boundary conditions at the in/outlet; boundary conditions at the wall; particle/wall and particle/particle interaction were discussed in depth. It became clear to all that the above mentioned problems are of common concern for modelling flows in various possible applications.

12132 (N—88-11140, pp vp) **Four spot time-of-flight laser anemometer.** Wernet, M.P. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The newly constructed, four-spot anemometer was shown to perform as predicted. The new anemometer's measurement region has the required characteristics: wide acceptance angle and high spatial selectivity to permit measurements in turbulent, hostile environments.

12133 **(PB—88-107990/XAB) Turbulent-flow characterization and radiation from gaseous fuel jets. Annual report, April 1985-April 1986.** de Ris, J.; Delichatsios, M.A.; Markstein, G.H. (Factory Mutual Research Corp., Norwood, MA (USA)). 30 Apr 1986. 69p. NTIS, PC A04/MF A01.

This work addresses methods for increasing the radiant output from gaseous-jet diffusion flames by varying key parameters of the combustion process such as ambient oxygen concentrations, fuel additives, and air or fuel preheating, together with an investigation of the effects of turbulent jet flow on the levels of radiant output. A series of radiant output measurements in turbulent jet flames were obtained using a 1-mm-diameter nozzle burning propane and stabilized by oxygen. The latter flames have an initial laminar flame region followed by transition and a fully developed turbulent flame brush. Two separate distinct luminous zones are observed for the laminar and turbulent zones. Apparently, soot formed in the laminar zone is fully oxidized by the high straining rates associated with transition. The subsequent turbulent burning has low enough straining rates to permit renewed soot formation.

12134 (PB—88-109475/XAB) **Assessment of the use of three-dimensional flow modeling for heat-transfer calculations with FURDEC.** Cooper, S. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1987. 30p. (TPRD/M—1610/R87). NTIS, PC E05/MF E04.

The largest input dataset for the furnace heat-transfer program FURDEC is that which specifies the mass-flow distribution. At present, the data set is obtained either from isothermal scale-model measurements, which are processed by the AEOLUS program to satisfy mass conservation, or by using the BOREAS program to generate the flow field using correlations for the vorticity in the main recirculation zones. Neither method is entirely satisfactory for the rapid and accurate assessment of new furnace designs. The report describes calculations carried out by Imperial College for both front-wall and corner-fired furnaces using a kappa-epsilon turbulent-flow model. Comparisons are made with isothermal-flow measurements taken in scale models and an assessment of the adequacy of the flow predictions for heat-transfer calculations is made.

12135 (PB—88-853650/XAB) **Finned-tube heat exchangers. January 1974-December 1985 (citations from the Engineering Index data base). Report for January 1974-December 1985.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 233p. NTISPC N01/MF N01.

This bibliography contains citations concerning theoretical studies and applications of finned tubing in a variety of heat-exchanger design configurations. The effects of turbulent and laminar flow are presented in terms of heat transfer for both external and internal finned surfaces. Energy-conservation and waste-heat-recovery systems are featured and the use of refrigerants is also included. (This updated bibliography contains 342 citations, none of which are new entries to the previous edition.)

12136 (PB—88-853668/XAB) **Finned-tube heat exchangers. January 1986-November 1987 (citations from the Engineering Index data base). Report for January 1986-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 42p. NTISPC N01/MF N01.

Supersedes PB—86-854635.

This bibliography contains citations concerning theoretical studies and applications of finned tubing in a variety of heat-exchanger design configurations. The effects of turbulent and laminar flow are presented in terms of heat transfer for both external and internal finned surfaces. Energy-conservation and waste-heat-recovery systems are featured and the use of refrigerants is also included. (This updated bibliography contains 80 citations, all of which are new entries to the previous edition.)

12137 **Inverse heat conduction.** Beck, J.V.; St. Clair, C.R.; Blackwell, B. New York, NY; John Wiley and Sons Inc. (1985). 336p. John Wiley and Sons Inc., 605 Third Avenue, New York, NY 10150.

This book discusses the engineering problem of determining surface heat flux and temperature history based on interior temperature measurements. It also provides the analytical techniques needed to arrive at otherwise difficult solutions, summarizing the findings of the last ten years. Topics include the steady state solution, Duhammel's Theorem, ill-posed problems, single future time step, and more.

4205 Materials Testing

REFER ALSO TO CITATION(S) 11792, 11825, 11862, 12059, 12083

12138 (CONF-8706187—, pp 131-138) **Automated multiviewing ultrasonic technique for flaw reconstruction.** Thompson, D.O.; Hsu, D.K.; Wormley, S.J. (Iowa State Univ., Ames). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Key achievements in the development of an automated multiviewing ultrasonic instrumentation for flaw characterization in materials are described. Based on ultrasonic signals scattered from the flaw in a number of directions, the signal processing algorithms provide a reconstruction of the size, shape, and orientation of the flaw. To improve the reconstruction reliability for arbitrarily oriented flaws, an angular scan plan is developed to select the most favorable data acquisition aperture configuration for a given flaw. Reconstruction results are presented. Electronic circuits are developed for the generation and detection of broadband unipolar ultrasonic pulses in order to characterize flaws over a wider size range. A second generation multiview transducer has been developed to incorporate these capabilities. The instrumentation and the associated signal processing algorithms form a unique research and inspection tool.

12139 (CONF-8706187—, pp 139-145) **High-sensitivity optical probe for photothermal measurements.** Fanton, J.T.; Kino, G.S. (Stanford Univ., CA). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A new displacement sensor for photothermal and photoacoustic measurements has been developed. This sensor employs a Wollaston prism to split a laser beam into two components which are focused to the sample where they interferometrically measure the periodic thermal expansion of the surface. Because the two beam paths are nearly coincident and equal in length, this probe is extremely resistant to noise sources that can severely limit other interferometers, even when using poor-coherence semiconductor laser sources. The high sensitivity, excellent definition, and simple construction of this sensor make it a candidate for a parallel system in which a large number of spots on the sample are measured simultaneously. It is the eventual aim of this work to be able to make two-dimensional photothermal images at much greater speed than the present very slow rates.

12140 (CONF-8706187—, pp 146-152) **Acoustic emission digital data acquisition workstation.** Johnson, J.A.; Barna, B.A.; Allemeier, R.T. (Idaho National Engineering Lab., Idaho Falls). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

A digital acoustic emission (AE) data acquisition system has been used to record the acoustic emissions generated by individual crack initiation sites during fracture. The purpose of this research is to analyze the dynamics of crack growth and to discriminate among fracture mechanisms through pattern analysis of the received signals. Preliminary experiments were performed using a laser as an AE source for calibration, and data were collected from a tensile test of an aluminum surface-cracked specimen. During the laser calibration experiments the AE from a focused Nd-YAG laser spot, which was translated 2.0 mm across a sample in 0.1 mm steps, were recorded and used to locate the origin of the AE. The results showed the basic capability of the system to discriminate between initiation sites less than 100 μm apart. The aluminum fracture experiment showed the capability of an enhanced system to record real events with a response time of less than 12 ms between events. The dynamics of the initiation site evolution show the progression of the crack growth across the pre-crack tip. Research is now being pursued to both validate these preliminary results and utilize the information on the dynamics of the fracture event.

12141 (CONF-8706187—, pp 153-160) **Crack characterization by scattering methods.** Achenbach, J.D. (Northwestern Univ., Evanston, IL). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Geometrical irregularities and material inhomogeneities in the vicinity of a crack can significantly affect the scattered fields that are generated by incident ultrasonic waves. Some results that display the effect of deviations from a mathematically perfect simple crack geometry are reported. Most of the results have been obtained by formulating a set of singular integral equations for the fields on the boundaries of the scattering obstacles. These equations have been solved numerically by the boundary element method,

and the scattered fields have subsequently been obtained by using representation integrals.

12142 **(ENEA-RT-VEL—86-1) Conversion into numerical form of radiographic images.** Cappabianca, C.; Della Rocca, A.B.; Ferriani, S. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1986. 18p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701003/JAW.

Radiographic means are widely used for non destructive testing. However, human and technological factors strongly influence reliability of the results and further use of these technique. Image Processing can help to overtake those difficulties if radiographic films are previously digitized. This paper shows methods and equipments used in this field. The system EDI (Enea Digital. Imagery) operating in Casaccia Energy Research Centre is described. 7 figs.

12143 **(ENEA-RT-VEL—87-2) Application range of micro focus radiographic devices associated to image processors.** Cappabianca, C.; Ferriani, S.; Verre, F. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1987. 15p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701286/JAW.

X-ray devices having a focus area less than 100 μ are called micro focus X-ray equipment. Here the range of application and the characteristics of these devices including the possibility of employing the coupling with real time image enhancement computers are defined. 20 figs.

12144 **(INIS-mf—11057) Simplified physical approach of the control by eddy current.** Zergoug, M. (Haut Commissariat a la Recherche, Algiers (Algeria). Centre d'Etudes Nucleaires et Solaires). Jan 1986. 124p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701076/JAW.

The aim of this study is to calculate the variation of the resistance of coil surrounding a non ferromagnetic cylindrical core in the presence of a flaw. The flaw is a longitudinal notch with an infinite length and a rectangular section. The impedance variation is to be calculated from the geometric repartition of the flow lines in the core. This repartition is a function of the flaw is given by the variation produced by the presence in the non ferromagnetic, conducting core of an emerging axial flaw which length. It is therefore possible to obtain in real time, on a computer screen, the image of a long standard flaw which may produce the observed impedance variation.

12145 **(PB—88-108931/XAB) Viscosity measurements at high temperatures on a standard reference material supplied by BCR (Bureau Communite de Reference).** Bagha, S.; Mills, K.C. (National Physical Lab., Teddington (UK). Div. of Material Applications). 1987. 34p. (NPL-DMA(A)—146). NTIS, PC E04/MF E04.

High-temperature viscosity measurements have been obtained on a standard reference material (SRM) using the rotating bob technique. The SRM was found to be both chemically and thermally stable and gave a consistent and reproducible set of values. Similar values of the viscosity were obtained when using molybdenum and graphite.

12146 **(PB—88-853411/XAB) Nondestructive testing of metals: magnetic methods. January 1973-November 1987 (citations from information services in Mechanical Engineering data base). Report for January 1973-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 144p. NTISPC N01/MF N01.

Supersedes PB—85-866986.

This bibliography contains citations concerning magnetic methods for the nondestructive testing of metals. The application of magnetorestrictive devices for the inspection and detection of cracks, surface flaws, and weld defects is presented. (This updated bibliography contains 372 citations, 84 of which are new entries to the previous edition.)

12147 **(PINSTECH/NPD—116) Study of defects in welded zircaloy-4 using transmission electron microscopy.** Shaikh, M.A.; Shoaib, K.A.; Khan, J.A.A.; Bukhari, S.J.H. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.). Jun 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701223/JAW.

Zircaloy-4 is used as a cladding material in CANDU type nuclear power reactors. The technique of electron microscopy has been used for the investigation of microstructural defects produced in zircaloy-4 due to the quenching treatment received during welding. This report describes the experimental results on the determination of Burgers vector of the dislocation loops. Identification of the nature of the defects, i.e., whether these are vacancy loops or hydride precipitates using electron diffraction analysis is discussed. Quantitative measurements of loop size distributions and density of loops are reported. Variation of vacancy concentration with distance from the molten zone is also presented. (author). 9 figs, 17 refs.

12148 **(SAND—87-1360C) Flaw identification from forced vibration testing.** Rogers, J.D.; Hollingshead, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-880220—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002641/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

A continuous system approach to the vibration characteristics of a symmetrically slotted beam has been developed. The beam was modelled as a Bernoulli-Euler beam with a reasonable stress distribution associated with the slots. The equation of motion was developd and resonant frequencies obtained from Rayleigh's Quotient. An experimental study of an aluminum beam with symmetrical slots was performed. The resonant frequency and apparent mass (a measure of damping) were measured. Reasonably good correlation in natural frequencies between theory and experiment was obtained. The reduction in natural frequency was a more sensitive indicator of damage than was the increase in damping. 7 refs., 7 figs.

12149 **(UCID—21263) Computed tomography and advanced x-ray and charge-particle imaging.** Martz, H.; Brase, J.; Azevedo, S.; Ryon, R. (Lawrence Livermore National Lab., CA (USA)). 17 Sep 1987. Contract W-7405-ENG-48. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003728/JAW.

The ability to nondestructively inspect materials, parts, and assemblies quantitatively and at high spatial resolution is fundamental to the mission of Lawrence Livermore National Laboratory (LLNL). Over the past several years developments in electronics, computers, and x-ray optics have revolutionized x-ray imaging capabilities. This project has three major goals: first, to provide a capability for X-ray Computerized Tomographic (CT) imaging to the Laboratory programs in general; second, to investigate and develop new techniques for improving the quality and turn-around time for reconstructed CT images; and third, to develop the models and tools necessary to understand special imaging problems for materials important to LLNL programs. The first goal will be met by the development of three x-ray CT systems. The second goal will be addressed by incorporating new model-based reconstruction algorithms and fast computer implementations in the data processing stages of CT. To meet our third goal, we will develop techniques in heavy charged-particle (large mass compared to an electron) CT and spectral CT which will allow total electron density and element specific inspection of low-density materials. 10 refs., 2 figs.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 11193, 11403, 11773, 11774, 11931, 12075, 12094, 12097, 12271, 12276, 12368

12150 **(AD-A—184820/9/XAB) Amorphous W-Zr films as diffusion barriers between Al and Si.** So, F.T.; Zhao, X.A.; Kolawa, E.; Tandon, J.L.; Zhu, M.F. (California Inst. of Tech., Pasadena (USA)). 1986. 7p. NTIS, PC A02/MF A01.

Cosputtered W70Zr30 and W40Zr60 films are investigated as diffusion barriers between Aq and Si. W-Zr alloys of both compositions were determined by x-ray diffraction to crystallize at 900°C on Al_2O_3 substrates. On <111>Si the W-Zr alloy reacts with the substrate above 700°C, forming a uniform, polycrystalline layer of W and Zr silicides. Despite the high crystallization temperatures, an Al overlayer interacts with W-Zr and the Si substrate at approx. 500°C. MeV He-backscattering spectrometry, SEM, and EDAX indicate that this reaction is laterally nonuniform with the formation of deep pits penetrating into the Si substrate. The authors believe this to be a consequence of fractures in the W-Zr layer induced by reaction with Al. Electrical measurements on shallow junction diodes with <Si>/W-Zr/Al contacts show that the device junctions were thermally stable after a 30 min annealing at 450°C but were all shorted after heat treatments at 500°C or above.

12151 **(AD-A—184984/3/XAB) On-orbit frequency stability analysis of the GPS NAVSTAR 8 rubidium clock and NAVSTARS 9 and 10 cesium clocks. Memorandum report, January-December 1985.** Buisson, J.A.; Largay, M.M. (Naval Research Lab., Washington, DC (USA)). 17 Sep 1987. 51p. (NRL-MR—6076). NTIS, PC A04/MF A01.

This report describes the on-orbit frequency stability performance analysis of the Global Positioning System (GPS) NAVSTAR 8 rubidium clock and the NAVSTARs 9 and 10 cesium clocks. Time-domain measurements, taken from three GPS monitor sites and from the United States Naval Observatory (USNO), were analyzed to determine the short and long-term frequency-stability performance of the NAVSTAR clocks. The data presented include measurements from 1985.

12152 **(AD-A—185146/8/XAB) Thermal-index changes by optical absorption in Group 3-5 semiconductor waveguides.** Gabriel, M.C.; Haus, H.A.; Ippen, E.P. (Massachusetts Inst. of Tech., Cambridge (USA). Research Lab. of Electronics). Oct 1986. 14p. NTIS, PC A03/MF A01.

Pub. in Jnl. of Lightwave Technology, Vol. LT-4, No. 10, 1482-1493(Oct 1986).

Large fast-relaxing intensity-dependent refractive-index changes would make certain all-optical signal-processing devices in waveguides feasible. In III-V compound materials, light-induced index changes can arise from any of several physical mechanisms that have different strengths and relaxation times. Index changes from 1.06-micrometer pulsed and CW Nd;YAG laser excitation were measured in single-mode low-loss InP and GaAs waveguide Fabry-Perot structures. The dominant effect was found to be due to heating of the waveguide volume, which accompanies an extremely small amount of free-carrier absorption.

12153 **(AD-A—185254/0/XAB) Application and deterioration of thin films used for microelectronic devices.** Hummel, R.E. (Florida Univ., Gainesville (USA)). 1987. 24p. NTIS, PC A03/MF A01.

Pub. in Thin Metal Films and Gas Chemisorption, 111-133(1987).

Microelectronic technology makes use of the knowledge and characterization methods of thin films and of our understanding of interfaces between thin films or between films and substrates. (See in this context some of the other papers in this book). The present contribution deals accordingly with thin films utilized in microelectronic devices. It needs to be realized that computers and other related devices depend heavily on metallic or semiconducting layers that often have only the size of one-tenth of the thickness of a human hair. As the electronic devices shrink, these layers represent an ever-greater fraction of the total device volume. These very films actually determine the electrical characteristics and also the stability (reliability) of the devices.

12154 **(BNL—40464) Design of a charge sensitive preamplifier on high resistivity silicon.** Radeka, V.; Rehak, P.; Rescia, S.; Gatti, E.; Longoni, A.; Sampietro, M.; Holl, P.; Strueder, L.; Kemmer, J. (Brookhaven National Lab., Upton, NY (USA); Politecnico di Milano (Italy); Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.); Technische Univ. Muenchen, Garching (Germany, F.R.)). 1987. Contract AC02-76CH00016. 6p. (CONF-871006—20). NTIS, PC A02. Order Number DE88003491/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

A low noise, fast charge sensitive preamplifier was designed on high resistivity, detector grade silicon. It is built at the surface of a fully depleted region of n-type silicon. This allows the preamplifier to be placed very close to a detector anode. The preamplifier uses the classical input cascode configuration with a capacitor and a high value resistor in the feedback loop. The output stage of the preamplifier can drive a load up to 20pF. The power dissipation of the preamplifier is 13mW. The amplifying elements are "Single Sided Gate JFETs" developed especially for this application. Preamplifiers connected to a low capacitance anode of a drift type detector should achieve a rise time of 20ns and have an equivalent noise charge (ENC), after a suitable shaping, of less than 50 electrons. This performance translates to a position resolution better than 3μm for silicon drift detectors. 6 refs., 9 figs.

12155 **(ORNL—6431) Crosstalk analysis of a broadband data communications system.** Crutcher, R.I.; Ewing, P.D.; Hayes, T.W. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003652/JAW.

A broadband cable system represents a significant resource for data transmission within a facility. Duplication of a broadband network to provide services of varying sensitivity levels within the same area is wasteful of capital resources. The sharing of a network by different data services is financially attractive providing that sensitive data are inaccessible from nonsensitive ports. The use of equipment from two manufacturers introduces a deliberate incompatibility for the purpose of data isolation. This report presents test results obtained by this technique. 4 refs., 26 figs.

12156 **(SAND—87-2764C) Effects of x irradiation and high field electron injection on the electrical properties of rapid thermal oxides.** Schubert, W.K.; Seager, C.H. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 3p. (CONF-8705223—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002642/JAW.

From Electrochemical Society meeting; Atlanta, GA, USA (15 May 1987).

Rapid thermal oxidation (RTO) is a promising tool for fabricating the thin gate oxides (5 to 15 nm) that will be needed in future submicron integrated circuits, because of its inherently superior time-temperature control when compared to conventional oxidation methods. It is important to demonstrate that RTO can be used without adversely affecting the radiation hardness or high field properties of the oxide. Beyond this demonstration, rapid thermal processing makes it possible to determine more precisely how the kinetics of oxidation and post oxidation annealing affect the device properties. Information of this type should prove useful in modeling relevant defect formation mechanisms. The present paper is part of a systematic study of the effects of rapid thermal processing on the radiation and high field response of thin oxides. 4 refs., 4 figs.

12157 **(UCID—21247) Evaluation of CWMS [continuous-wave measurement system] single-wire dipole antenna.** Breakall, J.K.; Christman, A.M. (Lawrence Livermore National Lab., CA (USA)). 30 Nov 1987. Contract W-7405-ENG-48. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003979/JAW.

The Numerical Electromagnetics Code (NEC) was used to model a "single-wire horizontal dipole antenna" used with the FCDNA continuous-wave measurement system (CWMS). Line

drawings and construction information were supplied to LLNL staff by FCDNA and EGG personnel, and NEC models were developed accordingly. Data were obtained from NEC describing all components of the electric and magnetic fields at nine different field-strength measurement points, as well as the input impedance at the antenna feed-point. Thirteen frequencies were used in the model, ranging all the way from 10 kHz to 100 MHz. In addition, the antenna was examined in two configurations, with and without a coaxial transmission line which extended from the feed-point balun to ground level. 16 figs., 46 tabs.

12158 **Compact waveguide power divider with multiple isolated outputs.** Moeller, C.P. (to Dept. of Energy, Washington, DC). US Patent 4,704,589. 3 Nov 1987. Filed date 27 May 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A device for splitting electromagnetic wave power, propagating in an electromagnetic wave transmission system is described comprising: (a) a length of input waveguide of rectangular cross-section; (b) output waveguides of rectangular cross-section each having an open end and a closed end, (c) slots of rectangular cross-section for intercommunicating the output waveguides to the input waveguide through a side wall of input waveguide. The slots are of a length in the direction of electromagnetic wave propagation such that the output waveguides are directionally coupled to the input waveguide.

12159 **Cermet insert high voltage holdoff for ceramic/metal vacuum devices.** Ierna, W.F. (to Dept. of Energy, Washington, DC). US Patent 4,704,557. 3 Nov 1987. Filed date 11 Mar 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A high voltage holdoff metal-to-ceramic seal for a vacuum device is described comprising: a metallic conductor; a body of ceramic material in sealing contact with the metallic conductor; and a region of cermet material substantially integral with the ceramic material and in electrical contact with the conductor. The cermet material has a resistivity less than the ceramic material, whereby the resultant resistivity gradient in the seal is effective to substantially increase the voltage holdoff capacity of the seal.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 10976, 11725, 11729

4210 Combustion Systems

REFER ALSO TO CITATION(S) 10817, 10883, 11721, 11737, 11807, 11808, 11809, 11810, 11812, 11813, 11814, 11815, 11817, 11818

12160 **(N—88-11140) Turbine engine hot section technology, 1985.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1985. 443p. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—). NTIS, PC A19/MF A01.

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The Turbine Engine Section Technology (HOST) Project Office of the Lewis Research Center sponsored a workshop to discuss current research pertinent to turbine engine hot section durability problems. Presentations were made concerning hot section environment and the behavior of combustion liners, turbine blades, and turbine vanes.

12161 (N—88-11140, pp vp) **Development of a high temperature static strain gage system.** Hulse, C.O.; Bailey, R.S.; Grant, H.P. (Pratt and Whitney Aircraft, East Hartford, CT). Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective of this program is to develop electrical resistance strain gages which will permit the measurement of static strains on nickel and cobalt superalloy parts inside gas turbine engines running on a test stand. The specific goal is to develop a complete system able to make strain measurements up to plus or minus 2000 mu strain with a total error of no more than plus or minus 10 percent over a 50 hour period at 1250 K. The initial part of this work consisted of a strain gage alloy development effort in which a variety of alloys were evaluated after being prepared by drop-casting or splat cooling.

12162 (N—88-11140, pp vp) **Elevated temperature strain gages.** Brittain, J.O.; Geslin, D.; Lei, J.F. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

Materials were evaluated that could be used in manufacturing electrical resistance strain gages for static strain measurements at temperatures at or above 1273 K. Strain gage materials must have a characteristic response to strain, temperature and time that is reproducible or that varies in a predictable manner within specified limits. Several metallic alloys were evaluated, as well as a series of transition metal carbides, nitrides and silicides.

12163 (N—88-11140, pp vp) **Lewis Strain Gauge Laboratory: Status and plans.** Hobart, H.F.; Will, H.A. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

An in-house lab was established for developing, testing, and evaluating high-temperature strain gauges and to aid in in-house applications of high-temperature strain instrumentation. The lab is automated to provide computer control of oven temperatures, imposed strain, and data sampling.

12164 (N—88-11140, pp vp) **Correlation of velocity and velocity-density turbulence in the exhaust of an atmospheric burner.** Fralick, G.C. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

In the experiment described herein, temperature (density) and velocity are measured separately but simultaneously as functions of time so that it is possible to determine the relationships among velocity, density, and the product of density and velocity. An atmospheric burner rig was used to provide the flow for the experiment.

12165 (N—88-11140, pp vp) **Improved numerical methods for turbulent viscous recirculating flows.** Turan, A. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The hybrid-upwind finite difference schemes employed in generally available combustor codes possess excessive numerical diffusion errors which preclude accurate quantative calculations. The present study has as its primary objective the identification and assessment of an improved solution algorithm as well as discretization schemes applicable to analysis of turbulent viscous recirculating flows. The assessment is carried out primarily in two dimensional/axisymetric geometries with a view to identifying an appropriate technique to be incorporated in a three-dimensional code.

12166 (N—88-11140, pp vp) **Aerothermal modeling program, phase 2.** Mongia, H.C.; Patankar, S.V.; Murthy, S.N.B.; Sullivan, J.P.; Samuelsen, G.S. (California Univ., Irvine). Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The main objectives of the Aerothermal Modeling Program, Phase 2 are: to develop an improved numerical scheme for incorporation in a 3-D combustor flow model; to conduct a benchmark quality experiment to study the interaction of a primary jet with a confined swirling crossflow and to assess current and advanced turbulence and scalar transport models; and to conduct experimental

evaluation of the air swirler interaction with fuel injectors, assessments of current two-phase models, and verification the improved spray evaporation/dispersion models.

12167 (N—88-11140, pp vp) **Fuel-injector/air-swirl characterization.** Mcvey, J.B.; Kennedy, J.B.; Bennett, J.C. (Connecticut Univ., Storrs). Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objectives of this program are to establish an experimental data base documenting the behavior of gas turbine engine fuel injector sprays as the spray interacts with the swirling gas flow existing in the combustor dome, and to conduct an assessment of the validity of current analytical techniques for predicting fuel spray behavior. Emphasis is placed on the acquisition of data using injector/swirler components which closely resemble components currently in use in advanced aircraft gas turbine engines, conducting tests under conditions that closely simulate or closely approximate those developed in actual combustors, and conducting a well-controlled experimental effort which will comprise using a combination of low-risk experiments and experiments requiring the use of state-of-the-art diagnostic instrumentation. Analysis of the data is to be conducted using an existing, TEACH-type code which employs a stochastic analysis of the motion of the dispersed phase in the turbulent continuum flow field.

12168 (N—88-11140, pp vp) **Efficient numerical techniques for complex fluid flows.** Patankar, S.V. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The aim of the present research program is the development of more efficient and reliable calculation schemes for the coupled momentum and continuity equations. The resulting schemes would significantly reduce the expense of computing complex flows such as those in combustion chambers, gas turbines, and heat exchangers.

12169 (N—88-11140, pp vp) **Dilution jet mixing program, phase 3.** Srinivasan, R.; Myers, G.; White, C. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objectives of the program were: (1) to extend the data base on mixing of a single-sided row of jets with a confined crossflow, (2) to collect a data base on mixing of multiple rows of jets with confined crossflow, (3) to develop empirical jet mixing correlations, and (4) to perform limited three-dimensional calculations for some of these test configurations. The tests were performed with uniform mainstream conditions for several orifice plate configurations. Schematics of the test section and the orifice configurations are given. Temperature and pressure measurements were made in the test section at 4 axial and 11 transverse stations, using a 60-element rake probe. The measured temperature distributions for these tests are reported.

12170 (N—88-11140, pp vp) **Mixing of a row of jets with a confined crossflow.** Holdeman, J.D. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

Mean temperature profiles calculated with an interactive microcomputer code which evaluates dilution-zone design alternatives are presented to show the effects of flow and geometric variables on the mixing of a single row of jets injected through sharp-edged orifices into a uniform flow of a different temperature in a constant area duct. In addition, this program is used to calculate profiles for opposed rows of jets with their centerlines in-line, by assuming that the confining effect of an opposite wall is equivalent to that of a plane of symmetry between opposed jets.

12171 (N—88-11140, pp vp) **Heat transfer in a real engine environment.** Gladden, H.J. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The hot section facility at the Lewis Research Center was used to demonstrate the capability of instruments to make required measurements of boundary conditions of the flow field and heat transfer processes in the hostile environment of the turbine. The results of thermal scaling tests show that low temperature and pressure rig tests give optimistic estimates of the thermal performance of a cooling design for high pressure and temperature application. The results of measuring heat transfer coefficients on turbine vane airfoils through dynamic data analysis show good comparison with measurements from steady state heat flux gauges. In addition, the data trends are predicted by the STAN5 boundary layer code. However, the magnitude of the experimental data was not predicted by the analysis, particularly in laminar and transitional regions near the leading edge. The infrared photography system was shown capable of providing detailed surface thermal gradients and secondary flow features on a turbine vane and endwell.

12172 (N—88-11140, pp vp) **Flow field measurements in a 90 degree turning duct.** Crawford, R.A.; Peters, C.E. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective of this investigation is the experimental evaluation of the influence of inlet turbulence intensity on secondary flow development in a turning duct. The existing 25.4 cm square turning duct (90) facility is being utilized to investigate effects of bulk turbulence levels on secondary flow development. The large scale duct flow facility allows detailed mean velocity and turbulence quantities to be measured at several streamwise planes in the curved duct. Non-intrusive laser velocimetry is being used to measure the mean and fluctuating components of velocity in all three orthogonal directions. To assure that the turbulence measurements are unbiased by particle lag and other effects, comparison hot wire data will be taken to validate the laser velocimetry system calibration.

12173 (N—88-11140, pp vp) **Measurement of airfoil heat transfer coefficients on a turbine stage.** Dring, R.P.; Blair, M.F.; Joslyn, H.D. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

A turbulence generating grid was designed and installed in the turbine inlet which produced the target nominal value of 10 percent free stream turbulence. Aerodynamic documentation of the rotor and stator midspan surface pressure distributions were obtained. Midspan heat transfer data were obtained on the rotor and stator for variations in inlet turbulence, rotor-stator axial spacing, and rotor incidence.

12174 (N—88-11140, pp vp) **Heat transfer in the tip region of a rotor blade simulator.** Metzger, D.E.; Chyu, M.K.; Moon, H.K. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective of this study of heat transfer in the tip region of a rotor blade simulator is to acquire, through experimental and computational approaches, improved understanding of the nature of the flow and convective heat transfer in the blade tip region. Such information should enable designers to make more accurate predictions of performance and durability, and should support the future development of improved blade tip cooling schemes.

12175 (N—88-11140, pp vp) **Coolant passage heat transfer with rotation.** Hajek, T.J.; Higgins, A.W. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective is to develop a heat transfer and pressure drop data base, computational fluid dynamic techniques, and correlations for multi-pass rotating coolant passages with and without flow turbulators. The experimental effort is focused on the simulation of configurations and conditions expected in the blades of advanced aircraft high pressure turbines. With the use of this data base, the effects of Coriolis and buoyancy forces on the coolant side flow can be included in the design of turbine blades.

12176 (N—88-11140, pp vp) **Heat transfer with very high free stream turbulence.** Moffat, R.J.; Maciejewski, P.K. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

Stanton numbers as much as 350 percent above the accepted correlations for flat plate turbulent boundary layer heat transfer have been found in experiments on a low velocity air flow with very high turbulence (up to 50 percent). These effects are far larger that have been previously reported and the data do not correlate as well in boundary layer coordinates (Stanton number and Reynolds number) as they do in simpler coordinates: h vs. X. The very high relative turbulence levels were achieved by placing the test plate in different positions in the margin of a large diameter free jet. The large increases may be due to organized structures of large scale which are present in the marginal flowfield around a free jet.

12177 (N—88-11140, pp vp) **Prediction of turbine blade heat transfer.** Patankar, S.V. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

It is planned to incorporate a number of low Reynolds number turbulence models in a general two-dimensional boundary layer calculation procedure. This will be applied to different flow conditions over turbine blades and the predictions will be compared with experimental data. The prediction activity will lead to a recommendation about a satisfactory turbulence model for turbine blade heat transfer.

12178 (N—88-11140, pp vp) **Flow in a model turbine stator.** Buggein, R.C.; Shamroth, S.J.; Briley, W.R. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

In view of the complex nature of the flowfield in the hot section of gas turbine engines, the need to predict heat transfer and flow losses, the possible appearance of separation and strong secondary flows, etc., the present effort is focusing upon a Navier-Stokes approach to the three dimensional turbine stator problem. The advantages of a full Navier-Stokes approach are clear since when combined with a suitable turbulence model these equations represent the flow and heat transfer physics. In particular, the Navier-Stokes equations accurately represent possible separated regions and regions of significant secondary flow. In addition, the Navier-Stokes approach allows representation of the entire flow field by a single set of equations, thus avoiding problems associated with representing different regions of the flow by different equations and then matching flow regions.

12179 (N—88-11140, pp vp) **3D inelastic analysis methods for hot section components.** Dame, L.T.; Chen, P.C.; Hartle, M.S.; Huang, H.T. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective is to develop analytical tools capable of economically evaluating the cyclic time dependent plasticity which occurs in hot section engine components in areas of strain concentration resulting from the combination of both mechanical and thermal stresses. Three models were developed. A simple model performs time dependent inelastic analysis using the power law creep equation. The second model is the classical model of Professors Walter Haisler and David Allen of Texas A and M University. The third model is the unified model of Bodner, Partom, et al. All models were customized for linear variation of loads and temperatures with all material properties and constitutive models being temperature dependent.

12180 (N—88-11140, pp vp) **3-D inelastic analysis methods for hot section components.** Todd, E.S. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective is to produce a series of new computer codes that permit more accurate and efficient three dimensional inelastic structural analysis of combustor liners, turbine blades, and turbine vanes. Each code embodies a progression of mathematical models for increasingly comprehensive representaion of the geometrical features, loading conditions, and forms of nonlinear material response that distinguish these three groups of hot section components.

12181 (N—88-11140, pp vp) **Component specific modeling.** McKnight, R. L.; Tipton, M. T. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective is to develop and verify a series of interdisciplinary modeling and analysis techniques that have been specialized to address three specific hot section components. These techniques will incorporate data as well as theoretical methods from many diverse areas including cycle and performance analysis, heat transfer analysis, linear and nonlinear stress analysis, and mission analysis. The new methods developed will be integrated to provide an accurate, efficient, and unified approach to analyzing combustor burner liners, hollow air-cooled turbine blades, and air-colled turbine vanes. For these components, the methods developed will predict temperature, deformation, stress, and strain histories throughout a complete flight mission.

12182 (N—88-11140, pp vp) **High temperature stress-strain analysis.** Thompson, R.L. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objectives of the high temperature structures program are threefold: to assist in the development of analytical tools needed to improve design analysis and procedures for the efficient and accurate prediction of the nonlinear structural response of hot-section components; to aid in the calibration, validation, and evaluation of the analytical tools by comparing predictions with experimental data; and to evaluate existing as well as advanced temperature and strain measurement instrumentation.

12183 (N—88-11140, pp vp) **Constitutive modeling for isotropic materials.** Lindholm, U.S. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The objective is to develop a unified constitutive model for finite element structural analysis of turbine engine hot-section components. This effort constitutes a different approach for non-linear finite-element computer codes which have heretofore been based on classical inelastic methods. The unified constitutive theory to be developed will avoid the simplifying assumptions of classical theory and should more accurately represent the behavior of superalloy materials under cyclic loading conditions and high temperature environments. During the first two years of the program, extensive experimental correlations were made with two representative uni-

fied models. The experiments were both uniaxial and biaxial at temperatures up to 1093 C (2000 F). In addition, the unified models were adopted to the MARC finite element code and used for stress analysis of notched bar and turbine blade geometries.

12184 (N—88-11140, pp vp) **Creep fatigue life prediction for engine hot section materials (isotropic): third year progress review.** Nelson, R.S.; Schoendorf, J.F. Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

This program is designed to investigate fundamental damage processes, identify modeling strategies, and develop practical models which can be used to guide the early design and development of new engines and to increase the durability of existing engines. A review is given of the base program, completed in 1984, which included the comparison and evaluation of several popular high-temperature life prediction approaches as applied to continuously cycled isothermal specimen tests. The option program, of which one year is completed, is designed to develop models which can account for complex cycles and loadings, such as thermomechanical cycling, cumulative damage, multiaxial stress/strain rates, and environmental effects.

12185 (N—88-11140, pp vp) **Experimental verification of vapor deposition rate theory in high velocity burner rigs.** Goekoglu, S.A.; Santoro, G.J. (Case Western Reserve Univ., Cleveland, OH). Oct 1985. NTIS, PC A19/MF A01. (NASA-CP—2405; E—2727; NAS—1.55:2405; CONF-8510485—).

From Turbine engine hot section technology; Cleveland, OH, USA (22 Oct 1985).

The main objective has been the experimental verification of the corrosive vapor deposition theory in high-temperature, high-velocity environments. Towards this end a Mach 0.3 burner-rig apparatus was built to measure deposition rates from salt-seeded (mostly Na salts) combustion gases on the internally cooled cylindrical collector. Deposition experiments are underway.

12186 (SPA—8302) **Prototype high efficiency furnace development. Final report.** Wright, J.L.; Briggs, R.J.; Sullivan, H.F. (Spider Engineering Associates (Waterloo), Inc., Ontario (Canada)). Feb 1983. 45p. (MICROLOG—84-1704). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report summarizes a project which was undertaken in order to develop and test prototype, high efficiency, condensing, gas furnaces. This research and development was undertaken in order to prove the operation and refine the design of a condensing gas furnace which utilizes a unique patentable recirulation loop. This recirculation loop cools the flue gas sufficiently to allow the use of plastic as a condensing heat exchanger material. Coroplast, a polyethylene/polypropylene copolymer extrusion, has been used for the construction of the condensing heat exchangers which were used to construct the prototype furnaces. The furnace development required successive design, construction and design refinement steps during the development of the current prototype model. This prototype furnace has been tested for reliability, safety and thermal performance. The prototype furnace has a steady state efficiency of 92%. The seasonal efficiency is not expected to differ significantly from the steady state efficiency. The recirculation loop is capable of cooling flue gas to below 95/sup 0/C. Coroplast appears well suited for use as a heat exchanger material in this application. The thermal performance is acceptable and the corrosion resistance of the plastic is very good. There was no evidence of plastic degradation in these tests or under normal furnace operation. Further research is recommended to be conducted into the economical manufacture and sealing of the Coroplast heat exchanger. 14 figs.

12187 **Individual burner control for combustion optimization in industrial boilers.** Batra, S.K.; Cole, W.; Metcalfe, C. (Tecogen, Inc.). pp 337-349 of Coal technology '86: Book II. Houston, TX; Coal Technology (1987). (CONF-861129—).

From Coal Technology '86: international coal utilization conference and exhibition; Pittsburgh, PA, USA (18 Nov 1986).

Combustion of fuels in large industrial boilers is monitored by measuring CO, CO/sub 2/, and O/sub 2/ in the flue gas exiting the boiler. Based on these measurements, combustion controls regulate the quantity of fuel and air flow in the boilers. Since the measurements are made in the ducts after the air preheater, these are affected by the leakage of air into the ducts. Also, in order to ensure complete combustion of the fuels, an excess amount of the air is supplied to each of the burners than under ideal conditions. An optimum range of excess air exists for each combination of fuel, firing mode and furnace condition. Presently, the combustion control system varies the air-fuel ratio in all or a set of burners, depending upon the choice of the type of control system. Due to differences in the individual burner characteristics, because of wear and tear and differences in fuel and air flow because of different flow characteristics in each burner, a higher excess air level is maintained than necessary for optimum combustion of the fuels. This results in excessive losses in stack gases. Also, should the burner(s) be operating under reducing conditions due to curtailment of excess air because of maldistribution, severe slagging can result in the boiler furnace. Thermo Electron Corporation has under development an instrument called Spectral Flame Analyzer for monitoring the combustion conditions in individual burners in a multi-burner boiler. The instrument is presently being tested in an industrial boiler. The paper describes the principle of operation of the Specrral Flame Analyzer, the results of the test carried out at the M.I.T. Combustion Research Facility and the proposed test program for an industrial boiler at the Polaroid Company.

4220 Underground Engineering

12188 **(CIM—87/162) Mine assisted petroleum recovery: an important concept for Canada.** Stephenson, H.G.; Owen, H.D.; Greenwell, J.; Krpan, N. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1987. 20p. (CONF-8705228—). Canadian Institute of Mining and Metallurgy, 400 - 1130 Sherbrooke Street, W., Montreal, P.Q., Canada H3A 2M8; $5.00 CAN.

From 89. annual general meeting of CIM; Toronto, Canada (3 May 1987).

This paper briefly describes different concepts for the utilization of shafts and tunnels to recover liquid hydrocarbons from various types of reservoirs found in Canada, including oil sands deposits, heavy oil reservoirs, and conventional oil reservoirs that have been partially depleted. The potential advantages and disadvantages of mine assisted concepts, compared to conventional recovery using wells drilled from surface locations, are examined. Mine assisted petroleum recovery requires the utilization of underground mining techniques for the construction of shafts and tunnels and the provision of ventilation, strata control, etc.; drilling, completion, and servicing of horizontal wells using a combination of technologies from the mining, exploration, and oil industries; and in situ process operations and reservoir engineering. The safety and operating problems encountered in combining these technologies are described, as well as measures to eliminate or mitigate these problems.

12189 **(DOE/ER/10386—T3) Particle deposition in granular media: Progress report.** Tien, Chi. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). 1987. Contract AC02-79ER10386. 168p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88002927/JAW.

This paper discusses topics on particle deposition in granular media. The six topics discussed are: experimental determination of initial collection efficiency in granular beds - an assessment of the effect of instrument sensitivity and the extent of particle bounce-off; deposition of polydispersed aerosols in granular media; in situ observation of aerosol deposition in a two-dimensional model filter; solid velocity in cross-flow granular moving bed; aerosol deposition in granular moving bed; and aerosol deposition in a magnetically stabilized fluidized bed. (LSP)

12190 **(LA—11144-MS) Rock mass property characterization for underground basing of defense facilities.** Van Eeckhout, E.; Albright, J.; Einstein, H.; French, R.; O'Brien, J. (Los Alamos National Lab., NM (USA)). Nov 1987. Contract W-7405-ENG-36. 168p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88002759/JAW.

Rock mass properties of importance to underground basing of defense facilities are detailed. Major concerns are opening stability underground, stress wave attenuation through rock, habitat maintenance underground, electromagnetic properties in communications, and tunnel excavation and boring. Remote, field, and laboratory methods of determining the appropriate rock mass properties are referenced or explained. 187 refs., 55 figs., 29 tabs.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 11799, 13899

12191 **(CIM—87/163) Offshore tunneling for oil: the Petromine concept.** Holestoel, K. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1987. 14p. (CONF-8705228—). Canadian Institute of Mining and Metallurgy, 400 - 1130 Sherbrooke Street, W., Montreal, P.Q., Canada H3A 2M8; $5.00 CAN.

From 89. annual general meeting of CIM; Toronto, Canada (3 May 1987).

A Norwegian oil mine concept has been developed since 1978. The Petromine concept consists of a system of caverns and tunnels in the rocks at a safe distance (300-400 m) below the bottom of the sea for the production and transport of oil and gas from offshore reservoirs. The concept is most competitive where oil and gas fields lie fairly close to shore, but out of reach of the available shore based drilling equipment, and in deep water. Furthermore, reservoirs situated in areas of severe climate or high ecological sensitivity could favourably be exploited by this concept. Due to the dramatic fall in oil prices in the first half of 1986 and the following reduction in the level of exploration activities, the Petromine Company decided to temporarily stop the self-financed development work from the end of 1986. This report more fully describes the Petromine concept, its construction, technology, safety hazards, and economics. Also included are the environmental benefits of this method of construction and implications for future application.

12192 **(DNV/C—8608) Evaluation of fracture toughness data with respect to reliability of subarctic and arctic structures. Final report.** Tomin, M.J.; Lantos, S.L. (Det Norske Veritas (Canada) Ltd.). Aug 1986. 192p. (MICROLOG—87-02206). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This study describes and demonstates the application of probabilistic methods for the strength assessment of tubular joints of offshore structures. The low arctic temperatures can initiate unstable fracture from cracks developed during fabrication or the design life of structures. The probabilistic analysis was based on two failure mechanisms of fatigue crack propagation and unstable fracture. The computer program PROBAN has been used for the analyses reported. The study evaluates the sensitivity of failure to such basic factors as fracture thoughness of the base plate and the heat affected zone, initial flaw size, crack growth parameters, hot spot stress range and nominal stress. The results obtained provide the basis for extending the applicability of standard and high strength steels to low temperature service.

12193 **(OTIFBI—8706) Responses and comments on the report of the West Coast Offshore Exploration Environmental Assessment Panel. A report.** (Ontario Tree Improvement and Forest Biomass Inst., Maple (Canada)). Jun 1987. 194p. (In English and French). (MICROLOG—87-04803). Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In September 1983 a Memorandum of Agreement signed by the Governments of Canada and British Columbia established the basis for a joint federal-provincial public review of the potential environmental and directly related socio-economic effects of renewed West Coast offshore oil and gas exploration. A five member West Coast Offshore Exploration Environmental Assessment Panel was appointed to conduct the public review. The Panel was instructed to examine the environmental and related socio-economic effects of offshore petroleum exploration, and to present recommendations on the terms and conditions under which offshore petroleum exploration in waters north of Vancouver Island could proceed in a safe and environmentally responsible manner. This report provides a general overview of the ten broad topics of concern outlined in the Panel's report. The Panel has made a number of recommendations on the need for further biophysical and socio-economic studies and has expressed some reservations about existing offshore practices, drilling techniques and the effectiveness of countermeasures. Several studies have been initiated or were previously underway, to address some recommendations. Included are a surface current program, coastal resource mapping studies of the Queen Charlotte Islands and completion of a baseline inventory of seabird colonies in the region. Additional initiatives include a study of the rearshore populations of seabirds by the Canadian Wildlife Service, a government/industry taskforce to assess the use and environmental implications of drilling muds, and the appointment of an advisory committee to examine and develop waste treatment guidelines for the Canadian offshore. The Department of Fisheries and Oceans is also undertaking a review of its internal hydrocarbon-fisheries research priorities.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 11401, 12457, 12468, 12504

12194 **(PB—88-107503/XAB) Biological detoxification research: potential uses for a fungal species.** Glaser, J.A.; Sferra, P.R. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Sep 1987. 12p. (EPA—600/D-87/301). NTIS, PC A03/MF A01.

Some of the more-common substructures of lignin, catechol diethers, alkylarenes, and biphenyls, resemble the chemical structure of many persistent organic compounds contaminating the environment. The remarkable similarity in structure led several investigators to research the applicability of a white rot fungus, Phanerochaete chrysosporium, to the biodegradation of hazardous waste constituents. The Hazardous Waste Engineering Research Laboratory of the U.S. Environmental Protection Agency has funded research to determine the feasibility of using P. chrysosporium to degrade organic pollutants. The white rot fungus research continues to stimulate interest and shows promise for field applications. The parts of the research program sponsored by the Hazardous Waste Engineering Research Laboratory are starting to develop major advances in the emerging biological control technology field.

4250 Power Cycles

REFER ALSO TO CITATION(S) 12076

12195 (NEDOJ—501, pp 865-890) **Development of general wide purpose stirling engine.** Aug 1985. (In Japanese). NTIS (US Sales Only), PC A99. Order Number DE88770030/JAW.

In FY 1984 NEDO Annual Report.

This is an annual report for 1984 on the project of developing a sterling engine. (1) 3 KW class displacer type for air conditioning (NS03M); A performance test of the trially-made engine was carried out by which a) data for 1,500 rpm operation was obtained, and b) pressure balance in the cylinder and the buffer varied by time. (2) 3 KW class 2-piston type for air conditioning (NS03T); Operating conditions of the trially-made engine were as follows: He pressure, 3 - 6.1 MPa.. Heater temperature, below 800°C.. Cooling water temperature, below 50°C. Maximum output, 3.46 KW.. Maximum thermal efficiency, 31.1 %. (3) 30 KW class for air conditioning (NS30A); Net efficiency of 31.6 % was obtained by a horizontal basic engine. (4) 30 KW class compact power engine (NS30S);

Final matching test gave the following results: (a) Point of maximum efficiency was in the vicinity of 1,000 rpm.. (b) Reduction of efficiency in the high speed region was little. (c) Reduction of efficiency in the high pressure region was little. (d) The efficiency remained at 85 % only of the targeted value. (36 figs, 3 tabs)

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 13066

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 12102, 13018

12196 **(FEI—1701) Optimization of a high-voltage accelerator gas-insulated structure.** Rezvykh, K.A.; Romanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701006/JAW.

Efficiency of the program complex for electrostatic field calculation developed to optimize the high-voltage accelerator structure is estimated. A system of optimal factors of the high-voltage structure is suggested. A method for modernization of the column - "twice oriented oval" - realized with the EhG-2.5 accelerator provides the increase of both break-down voltage and service life of high-voltage elements of the accelerator accounting low cost of modernization. 12 refs.; 2 figs.

12197 **(JAERI-M—87-115) JAERI Tandem, LINAC and V.D.G. annual report 1986. April 1, 1986 - March 31, 1987.** (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 250p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88751440/JAW.

This annual report describes research activities which have been performed with the JAERI tandem accelerator, the electron linear accelerator and the Van de Graaff accelerator from April 1, 1986 to March 31, 1987. Summary reports of 55 papers, and list of publications, personnel and cooperative researches with universities are contained.

12198 (N—88-10829, pp vp) **High intensity 5 eV O-atom exposure facility for material degradation studies.** Cross, J.B.; Spangler, L.H.; Hoffbauer, M.A.; Archuleta, F.A.; Leger, L.; Visentine, J.; Hunton, D.E. (Air Force Geophysics Lab., Hanscom AFB, MA). 1986. NTIS, PC A19/MF A01. (NASA-CP—2446; REPT—86B0561; NAS—1.55:2446; CONF-861182—).

From 14. space simulation conference; Baltimore, MD, USA (3 Nov 1986).

An atomic oxygen exposure facility was developed for studies of material degradation. The goal of these studies is to provide design criteria and information for the manufacture of long life (20 to 30 years) construction materials for use in low Earth orbit. The studies that are being undertaken will provide: (1) absolute reaction cross sections for the engineering design problems, (2) formulations of reaction mechanisms for use in the selection of suitable existing materials and the design of new more resistant ones, and (3) the calibration of flight hardware (mass spectrometers, etc.) in order to directly relate experiments performed in low Earth orbit to ground based investigations. The facility consists of a CW laser sustained discharge source of O-atoms, an atomic beam formation and diagnostics system, a spinning rotor viscometer, and provision for using the system for calibration of actual flight instruments.

12199 **(SLAC-PUB—4446) Linear collider research at SLAC.** Ruth, R.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1987. Contract AC03-76SF00515. 7p. (CONF-8710107—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003609/JAW.

From Future perspectives in high energy physics; Upton, NY, USA (5 Oct 1987).

This paper briefly discusses the four main subsystems to the Stanford linear collider: the damping rings, the bunch compression and pre-acceleration, the linac and the final focus. 8 refs., 2 figs., 3 tabs. (LSP)

12200 **Requirements for SSC central computing staffing (conceptual).** Pfister, J. (Fermilab, Batavia, IL). pp 321-324 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

Given a computation center with —10,000 MIPS supporting —1,000 users, what are the staffing requirements? The attempt in this paper is to list the functions and staff size required in a central computing or centrally supported computing complex. The organization assumes that although considerable computing power would exist (mostly for online) in the four interaction regions (IR) that there are functions/capabilities better performed outside the IR and in this model at a "central computing facility." What follows is one staffing approach, not necessarily optimal, with certain assumptions about numbers of computer systems, media, networks and system controls, that is, one would get the best technology available. Thus, it is speculation about what the technology may bring and what it takes to operate it. From an end user support standpoint it is less clear, given the geography of an SSC, where and what the consulting support should look like and its location.

12201 **Acceleration of particles by beat wave accelerator and surfatron.** Dawson, J.M. (University of California, Los Angeles, California 90024). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 61-84(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The possibility of using intense plasma waves to accelerate particles to high energy is discussed. This is of interest because of the very intense electric fields that can be generated (E≈√n/sub e/ Volts/cm) and the fact that the phase velocity can be essentially the speed of light. Particular attention is given to generating the waves by two intense laser beams with frequency difference equal to the plasma frequency (Beat Wave Accelerator) and using magnetic fields to maintain phase coherence of the accelerated particles with the plasma wave (Surfatron Accelerator). Results of extensive numerical simulation are given. Some of the advantages, disadvantages and important questions for these acceleration mechanisms are discussed.

12202 **High intensity hadron accelerators.** Teng, L.C. (Fermilab, P.O. Box 500, Batavia, IL 60510). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 101-115(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Accelerators needed to examine the intersections between nuclear and particle physics will require GeV energies with high beam intensities. Concerns about such high intensity machines are beam focusing, intensity limitations, power economics, and heavy ion applicability. These topics are the basis for this discussion. (AIP)

12203 **Accelerator-colliders for relativistic heavy ions or in search of luminosity.** Young, G.R. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 169-175(15 Nov 1984). (CONF-8405193—). Contract AC05-84OR21400.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Some issues pertinent to the design of collider rings for relativistic heavy ions are presented. Experiments at such facilities are felt to offer the best chance for creating in the laboratory a new phase of subatomic matter, the quark-gluon plasma. It appears possible to design a machine with sufficient exploration of the heaviest

nuclei in nature, to allow a thorough exploration of quark-gluon plasma.

12204 **LAMPF II.** Thiessen, H.A. (Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 176-196(15 Nov 1984). (CONF-8405193—). Contract AC05-84OR21400.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We present a plan for a 45-GeV 40-μA proton synchrotron with a 200-μA 9-GeV booster. These machines can provide simultaneously 45-GeV slow-extracted beam for production of kaons, antiprotons, and other secondary particles, and 9-GeV fast-extracted beam for neutrino and pulsed muon physics. The LAMPF II machines are compared with existing and proposed kaon factories. Relative to the Brookhaven AGS as it exists today, LAMPF II will provide 90 times as many neutrino events per year and 300 times as many kaons per year. A number of experiments requiring vastly increased beam current are examined. Two programs, the search for quark-gluon plasma using high-energy antiproton annihilation in nuclei, and the measurement of nuclear quark structure functions using the Drell-Yan process, address the highest priority problems of the NSAC long-range plan. Some of the design features of the LAMPF II accelerators are shown to be important for reducing beam losses and increasing beam availability.

12205 **AGS II.** Palmer, R.B. (Brookhaven National Laboratory, Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 197-208(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Interest in rare K decays, neutrino oscillations and other fields have generated an increasing demand for running, and improved intensity and duty cycle, at the AGS. Current projects include acceleration of polarized protons and light ions (up to mass 32). Future plans are for a booster to increase intensity and allow heavy ions (up to mass 200), and a stretcher to give 100% duty cycle. A later upgrade could yield an average current of 32 μ amps.

12206 **Berkeley Mini-Collider.** Schroeder, L.S. (Nuclear Science Division, Lawrence Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 217-226(15 Nov 1984). (CONF-8405193—). Contract AC03-76SF00098.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The Berkeley Mini-Collider, a heavy-ion collider being planned to provide uranium-uranium collisions at T/sub cm/ approx. <4 GeV/nucleon, is described. The central physics to be studied at these energies and our early ideas for a collider detector are presented.

12207 **Facilities and experiments at Fermilab.** Koehler, P.F.M. (Fermi National Accelerator Laboratory, Batavia, IL 60510). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 253-264(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

This paper describes the presently existing accelerator and research facilities at Fermilab as well as those currently being constructed. This is followed by a brief overview of the approved experiments for both the colliding beams mode and the fixed target mode of operation.

12208 **Effects of correction sextupoles in synchrotrons.** Ohnuma, S. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 415-423(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

In order to have a usable acceptance of the beam momentum spread (Δp/p), synchrotrons must have at least two families of correction sextupoles which are generally placed at locations where the momentum dispersion function is large. These sextupoles are often called chromaticity correction sextupoles since their function is to eliminate (or to change in the most desirable manner) the dependence of the tunes of betatron oscillation on (Δp/p) caused by the chromatic aberration of quadrupoles. This report describes various harmful effects arising from these sextupoles and suggests possible cures. In particular, it is emphasized here that the second-order effects be minimized in order to prevent a potentially disastrous reduction in the transverse acceptance of the ring even when the tunes are considered to be safely away from the lowest-order (i.e., third-integer) resonances. The terms responsible for the dependence of tunes on the betatron oscillation amplitudes are explicitly given as a function of the five integrals representing the resonance-driving terms of the lowest-order Hamiltonian. The expression involves sums of infinite number of Fourier components but they can all be computed analytically.

12209 **Intrabeam scattering in electron and proton storage rings (a review).** Ruggiero, A.G. (Fermi National Accelerator Laboratory). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 424-436(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Charged particle beams, in particular, electron and proton beams, in storage rings are susceptible to Coulomb scattering which will cause the beam dimensions to grow like an expanding cloud of gas in free space. This effect is called Intrabeam Scattering. This article is a review of this effect in electron and proton beams. (AIP)

12210 **Longitudinal tune control in synchrotrons.** Colton, E.P. (Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 437-443(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Dual RF systems that use fundamental and higher-harmonic cavities can be used to control the longitudinal tune in synchrotrons. The equations of motion and the Hamiltonian are defined for particle motion using dual RF systems. An example is considered using a second-harmonic system: it is shown, that as phi/sub s/ is increased, a substantial gain in bucket area over a single RF system can be realized by proper relative phasing of the first- and second-harmonic voltages.

12211 **Physics with 3 GeV electrons.** Gross, F. (College of William and Mary, Williamsburg, VA 23185). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 458-467(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The physics program planned for the 4 GeV Continuous Electron Beam Accelerator Facility (CEBAF) is reviewed. It is explained how the desire to study the role of quarks in nuclei leads to the choice of 4 GeV for the energy, and why coincidence measurements seem so promising. Proposals to measure few-body wave functions, separate the deuteron monopole and quadrupole charge from factors, measure the neutron electric form factor, and photoproduce excited baryons are briefly described.

12212 **Time purified/separated antiproton beam at the AGS.** Bachman, M.; Barlett, M.L.; Bonner, B.; Borenstein, S.; Bridges, D.; Brown, H.; Buchanan, J.; Clement, J.C.; Daftari, I.; Debbe, R. (University of Texas at Austin). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 590-595(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A 1 km antiproton beam has been designed for construction at the AGS. The momentum band can be varied between +- 0.3% to +- 1.0%, and the resolution for tagged particles will be $\delta p/p \sim 10^{-4}$ at beam rates as high as 10^6 p-bar/s. Separation by decay

purification will be on the order of 1 p-bar/10($\pi^- + \mu^-$). This beam will be used in a detailed investigation of Charmonium including a measurement of the chi widths. We will also search for expected but as yet unseen states, and search for possible I = 1 events which would imply the existence of four quark states. This facility will also lend itself to a wide variety of exciting physics such as the proton form factor including both e^+e^- and $\gamma\gamma$ final states, two-body hadron final states, antinucleus yields, and possibly tagged hadron beams (i.e., Λ, γ, etc.). When heavy ions become available at the AGS, one can measure various long lived particle yields. Finally, with as many as 10^7 polarized muons in the beam, one has the possibility to use them for nuclear structure studies.

12213 **Slow kaon beams.** Colton, E.P. (Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 926-932(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A short description is given of considerations for the design of low-momentum kaon beam lines. Relevant data for the performance of seven existing and decommissioned slow kaon beams are presented. For single-stage separated beams the observed ratio π^- all/K^- is greater than 50 for momenta less than 500 MeV/c. We recommend a two-stage separated beam with perhaps an upstream "cleanup" section for maximal purity.

12214 **Accelerator summary.** Mills, F.E. (Fermi National Accelerator Laboratory, Batavia, IL 60510). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1126-1127(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A summary of the accelerator topics (CW electron accelerators, heavy ion colliders, kaon factories, polarized proton beams, and cooling rings) discussed in the 1984 conference on "Intersections Between Particle and Nuclear Physics" (Steamboat Springs) is presented. (AIP)

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 12199, 12255

12215 **(BNL—40542) Test results from 1.8-m SSC [Superconducting Super Collider] model dipoles.** Wanderer, P.; Cottingham, J.G.; Dahl, P.; Garber, M.; Ghosh, A.; Goodzeit, C.; Greene, A.; Herrera, J.; Kahn, S.; Kelly, E. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 4p. (CONF-870901—24). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88004442/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

We report results from the first four in a series of 1.8 m-long dipoles built as part of the Superconducting Super Collider (SSC) R and D program. Except for length, these models have the features of the SSC design, which is based on a two-layer cosθ coil with 4 cm aperture. As compared to 17 m, the SSC design length, these 1.8 m magnets are a faster and more economical way of testing changes in field shape, the ratio of copper to superconductor, cable support at the coil center and ends, and similar variables. The two most recent magnets in this series have the design field shape and improved quench performance.

12216 **(CONF-8706176—5) A condensed state in a system of stored and cooled ions.** Rahman, A.; Schiffer, J.P. (Minnesota Univ., Minneapolis (USA); Argonne National Lab., IL (USA); Chicago Univ., IL (USA)). 1987. Contract W-31109-ENG-38. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003068/JAW.

From Workshop and symposium on the physics of low energy, stored, and trapped particles; Stockholm, Sweden (14 Jun 1987).

In heavy-ion storage rings a beam of particles with uniform mass and (positive) charge, is confined to a narrow region around an equilibrium orbit. The internal temperature in the co-moving reference frame for such beams may be lowered by stochastic or electron cooling to very low values: 1°K has been reported for proton beams. If such conditions are indeed realized in heavy-ion beams, new types of condensation phenomena should appear. For laser cooling techniques even lower temperatures are anticipated.Progress is reported on studies of computer simulations of such systems using the method of Molecular Dynamics. 11 figs., 8 refs., 2 tabs.

12217 **(EFI—935(86)-86) Nonlinear effects in plasma wake field acceleration.** Amatuni, A.Ts.; Elbakyan, S.S.; Sekhposyan, E.V. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700972/JAW.

The possible use of the nonlinear wake waves excited by electron bunches passing throug plasma for acceleration of charged particles is investigated. The expressions for non-linear fields and wave lengths inside and behind the particle bunch are obtained. It is shown that when the bunch density approaches the half of the plasma electron equilibrium density the maximal wake field depends on the bunch γ-factor, and one can use it for charged particle acceleration. 32 refs.; 2 figs.

12218 **(EFI—943(94)-86) Magnetic lens for precision beam focusing.** Ogadzhannyan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700978/JAW.

The winding configuration of the magnetic lens which realizes the field focusing the beam simultaneously in both transverse directions according to the alternating-gradient focusing principle is considered. The space-periodic magnetic field of the lens is presented as a Fourier series; the amplitudes of harmoinics that are functionals of the bend shape of conductors in the winding are written out. The free parameters, i.e. the Fourier-harmonic amplitudes and the field period, can be optimized with respect to the beam dynamics, owing to the choice of the conductors bend shape in the winding. At decreasing the len aperture its focusing strength enhances and simultaneously there appears a possibility of shortening the magnetic field period without reduction of the field amplitude. This circumstance can be used with the lens proposed for the precise beam focusing. 5 refs.

12219 **(ENEA-RT-TIB—85-42) Quantum mechanical analysis of the free electron laser.** Dattoli, G.; Renieri, A. (ENEA, Frascati, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1985. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701277/JAW.

A quantum analysis of the Free Electron Laser is presented. The theory is developed both in single and longitudinal multimode regimes. Finally a self-consistent procedure to study the growth of the laser signal from the vacuum to the macroscopic level is presented. 52 refs

12220 **(FNAL-TM—1479) Tests of prototype SSC [Superconducting Super Collider] magnets.** Strait, J.; Brown, B.C.; Hanft, R.; Koepke, K.; Kuchnir, M.; Lundy, R.; Mantsch, P.; Mazur, P.O.; McInturff, A.; Orr, J.R. (Fermi National Accelerator Lab., Batavia, IL (USA); Brookhaven National Lab., Upton, NY (USA); Lawrence Berkeley Lab., CA (USA); Lawrence Berkeley Lab., CA (USA). SSC Central Design Group). 21 Sep 1987. Contract AC02-76CH03000. 5p. (CONF-870901—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003969/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

Results are presented from tests of the third full scale development dipole magnet for the Superconducting Super Collider and from a retest of a 4.5 m model magnet of the same design mounted in an SSC cryostat. The 4.5 m magnet shows consistent quench performance between its original tests in boiling liquid helium in a vertical dewar and the current tests in forced flow helium in a horizontal cryostat. Little or no retraining is observed over several thermal cycles. The full length magnet requires 12 quenches to train to its short sample limit of 6800 A and displays a reasonably

stable quench plateau following training. This represents a great improvement over the performance of the first two full length magnets. Data are presented on quench behavior as a function of current and temperature and on azimuthal and longitudinal loading of the coil by the support structure. 14 refs., 7 figs.

12221 **(FNAL-TM—1493) Measurements of magnetic field alignment.** Kuchnir, M.; Schmidt, E.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). 6 Nov 1987. Contract AC02-76CH03000. 5p. (CONF-870901—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003970/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The procedure for installing Superconducting Super Collider (SSC) dipoles in their respective cryostats involves aligning the average direction of their field with the vertical to an accuracy of 0.5 mrad. The equipment developed for carrying on these measurements is described and the measurements performed on the first few prototypes SSC magnets are presented. The field angle as a function of position in these 16.6 m long magnets is a characteristic of the individual magnet with possible feedback information to its manufacturing procedure. A comparison of this vertical alignment characteristic with a magnetic field intensity (by NMR) characteristic for one of the prototypes is also presented. 5 refs., 7 figs.

12222 **(FNAL-TM—1495) Simulation of bunches coalesing in the main ring, in the presence of a high-frequency, wide-band resonator.** Garoby, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). 4 Dec 1986. Contract AC02-76CH03000. 41p. NTIS, PC A03. Order Number DE88003968/JAW.

During the first part of the coalescing process, bunches are being stretched until they fill the ≈1 kV @ 53 MHz bucket. Applying the "Keil-Schnell-Boussard" criteria for microwave instability inside that bunch gives: vertical bar Z/n vertical bar ≦ 5.6 Ω for N/sub b/ = 10^{10} ppB. It is very likely that local instabilities develop inside the bunch during the manipulation. The computer program ESME was run under these conditions to give an approximate picture of the bunch distortions. Outputs are presented here. Since microwave signals had been observed during the second part of coalescing (bunch rotation), some simulations have been done at that part. No catastrophic degradation showed up with the model used, as the computer outputs indicate. 35 figs.

12223 **(IA—1422) Particle acceleration to high energies and amplification of coherent radiation by electromagnetic interactions in plasmas.** Loeb, A. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). May 1986. 123p. (In Hebrew). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701020/JAW.

Contains an annotated bibliography of 69 references.

An Autoresonance Laser Acceleration scheme permits the acceleration of charged particles, moving along an axisymmetric magnetic field, in the Doppler-shifted cyclotron resonance with a rotating electromagnetic field. The radiation losses in a TeV accelerator are negligible. An Nd:glass laser with an intensify of 10/sup 18/ W/cm/sup 2/ is capable of accelerating a high current electron beam from 0.25 to 2.5 GeV over 1 m along a 100 kG guide magnetic field. Significant exponential amplification with a gain factor of several tenths of cm/sup -1/ for strong milimeter radiation, is obtained in a plasma accelerator with MeV electron beams with current densities of several kA/cm/sup 2/. In electron-positron plasmas the acceleration is based on a self-sustained cyclotron resonance between the particles and a homogeneous, luminous, linearly-polarized laser radiation, propagating along an axial magnetic field. An electron (positron) which initially satisfies the cyclotron resonance condition, will be accelerated asymptotically to an energy of 0.82[(B/sub z/(100 kG/λ (10μm)/sup 1/2/ α/sub x/ z(m)]/sup 2/3/ GeV at a distance z along a magnetic field B/sub z/, by using a linearly-polarized laser field with amplitude α/sub x/ (eE/mωc) and wavelength λ.

12224 **(JINR—9-87-196) Electrostatic defocusing of a high-current shielded beam.** Aleksakhin, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701130/JAW.

Submitted to the X All-union seminar no linear accelerators of charged particles, Khar'kov 2-4 Jul. 1987.

Shielding of a high current electron beam electric self-field by the beam environment is considered as well as the effect of image charges on the beam centroid stability in the presence of a homogeneous longitudinal magnetic field. In particular, the polarization charges induced on the surface of a dielectric vacuum tube by the off-axis beam are found to destabilize the beam significantly. The influence of the image field non-linear dependence on the beam displacement is analysed. The threshold strength of the focusing magnetic field is shown to increase with the beam initial displacement, the effect being more pronounced for the magnetized beam. Since the longitudinal magnetic field provides a velocity focusing which strength falls with the beam energy increasing, the considered effects are most significant for high-energy high-current induction linacs. 4 refs.

12225 **(JINR-R—9-87-55) Statistical simulation of the electron beam coherent oscillations in the LIU-30 accelerator.** Rakityanskij, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701175/JAW.

Submitted to the journal Zh. Tekh. Fiz. .

In the framework of a simple model with a thread-like beam its lateral coherent oscillations are numerically explored. The statistical estimates for accelerating channel length limits due to that oscillation growth are obtained. The strong sensitivity of rate of that growth to nonuniformities of the longitudinal focusing magnetic field is found. The dependence of this rate on the field strength turns out to be nonmonotonous. The calculations performed for the LIU-30 accelerating structure show that it has the clear resonances. An accuracy tolerance of the accelerating module and magnetic lens assembly is estimated. The adjustment of the last, as it is found, has a determinative influence upon the coherent oscillation growth. Smoothing the longitudinal magnetic field nonuniformities improves the beam passage through an accelerating channel and reduces the requirements on the optical element adjustment. 8 refs.; 5 figs.

12226 **(JINR-R—9-87-148) Induced fields effect on the stability of the electron beam coherent oscillations in a linear accelerator.** Savvin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701176/JAW.

Submitted to the journal Zh. Tekh. Fiz. .

Influence of the induced electric and magnetic fields upon the lateral motion of the beam undergoing the coherent oscillations in a channel with longitudinal magnetic field is considered. It is shown that the presence of conducting surfaces surrounding the beam causes not only the coherent oscillation frequency shift but also the existance of a finite stability region. It is also shown that the bound lateral oscillation region decreases, going to a point, with the energy increases, if the induction of charges and currents takes place at surfaces of different radii. The magnetic field strength energy dependence is found with which small oscillations do not grow in the acceleration process. It is shown that if the fields are induced on the same surface, then the stability region increases and the small oscillation amplitudes decreases going in the limit to a constant value. 6 refs.; 3 figs.

12227 **(JINR-R—9-87-195) Approximate analysis of the accelerating systems loading by the back current method.** Aleksakhin, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701178/JAW.

Submitted to the X All-union seminar on linear accelerators of charged particles, Khar'kov, 2-4 Jun. 1987.

The interaction of charged particles with a structure formed by a waveguide with narrow gaps loaded on some impedances

(radial lines in particular) is studied by the beam current method. The method relation to the known in radioelectronics Ramo-Shockley theorem is discussed, corrections due to the excitation of secondary waves in the guide are found. A method is proposed for the direct derivation of the strict solution to the problem under consideration. Formulae for the energy losses by a charged-electron-ion ring passing a gap which is loaded on a radial line are given as well as their qualitative interpretation. 4 refs.

12228 **(KFTI—87-29) Collective acceleration of long-duration high-current ion beams in spatially-periodic magnetic field.** Tkach, Yu.V.; Magda, I.I.; Najsteter, S.I.; Onishchenko, I.N.; Gadetskij, N.P.; Pushkarev, S.S. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701397/JAW.

Two-stage model of ion beam acceleration with high-current REB in spatially-periodic magnetic field has been experimentally investigated. Nitrogen ion flux of 250 keV energy, 300 A current, 450 ns duration has been produced at the first acceleration stage. Numerical computer simulation of ion capture with slow wave of modulated REB has been performed. High radial and phase stability of the process has been shown, slow wave phase velocity in the system has been measured. Good coincidence with accelerated particle velocity has been obtained. Final energy of nitrogen ions is 5 MeV at 15 A beam current and 100 ns beam pulse duration. 6 refs.; 4 figs.; 1 tab.

12229 **(LA-UR—87-3046) Emittance studies at the Los Alamos National Laboratory Free-Electron Laser.** Carlsten, B.E.; Feldman, D.W.; Lumpkin, A.H.; Stein, W.E.; Warren, R.W. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 27p. (CONF-8709110—13). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003146/JAW.

From 9. international free-electron laser conference; Williamsburg, VA, USA (14 Sep 1987).

Recent emittance studies at the Los Alamos FEL have indicated several areas of concern in the linac and beamline feeding the wiggler. Four emittance growth mechanisms of special importance have been studied. First, a rapid growth of the electron beam's emittance immediately after the spherical gridded Pierce gun resulted, in part, from the long time required for our pulsing electronics to ramp the grid voltage up at the start and down at the end of the pulse, which created a pulse with a cosine-like current distribution as a function of time. The growth was compounded by the extremely small radial beam size (almost a waist) leaving the gun. In addition, we saw evidence of electrostatic charging of the insulators in the gun, reducing the quality of the electron beam further. Second, the action of the solenoidal focusing fields in the low-voltage bunching region was studied, and criteria for a minimum emittance growth were established. Third, maximum misalignment angles and displacements for various elements of the beamline were calculated for the desired low emittance growth. Finally, emittance growth in the horizontal dimension through the nonisochronous bend caused by varying energy depression on the particles due to longitudinal wake fields was both calculated and observed. In addition, we measured energy depressions caused by the wake fields generated by various other elements in the beamline. Strategies were developed to relieve the magnitude of these wake-field effects. 10 refs., 12 figs.

12230 **(SLAC/AP—60) A crude scaling law for lasertrons.** Rees, J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1987. Contract AC03-76SF00515. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003880/JAW.

The lasertron is under consideration in several laboratories as a promising new source of high-power microwaves that is competitive with conventional klystrons in its properties - particularly in efficiency. In this note, a crude scaling law for high-power lasertrons is derived based on the observation that the main limiting phenomenon, the phenomenon that curtails the tube's efficiency, is debunching due to longitudinal space-charge forces acting in the electron gun. The scaling law indicates that lasertrons are quite restricted in the power they can generate at high frequencies.

12231 **Counterstreaming electron-beam beat-wave accelerator.** Yan, Y.T.; McKinstrie, C.J.; Katsouleas, T.; Dawson, J.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **36**: No. 11, 5455-5458(1 Dec 1987).

The beat-wave excitation of plasma waves in a counterstreaming electron beam is studied, and the consequences for particle acceleration are discussed. Both the plasma-wave length and the pump-depletion length can be significantly longer than that in the plasma beat-wave accelerator. Thus the single-stage energy gain of the accelerated particles is greatly increased, whereas the injection energy for particle trapping is greatly reduced; this allows the possibility of ion acceleration.

12232 **Two dogmas of charged particle optics.** Carey, D.C. (Fermi National Accelerator Lab., Batavia, IL, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 417-420(15 Aug 1987). (CONF-860520—).

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

Designs of charged particle optical systems are invariably based on two assumptions: (1) The existence of a reference trajectory and (2) midplane symmetry. The reference trajectory is taken to be the path of a charged particle with certain specified initial conditions. Conditions which break the continuity of the reference trajectory are misalignments of magnets, excess horizontal field in a bending magnet, and vertically bending field in a horizontally bending magnet. Even if midplane symmetry is violated in a magnetic system it is usually respected in each magnetic element. Violations of midplane symmetry in a bending magnet occur if the field is not symmetric about the magnetic midplane. Equations of motion have been worked out for the case where both the above mentioned conditions are violated. Solutions have been produced and incorporated into the first- and second-order formalism of charged particle optics.

12233 **Effects of dipole magnet inhomogeneities on the beam ellipsoid.** Tsoupas, N.; Colman, J.; Levine, M.; McKenzie-Wilson, R.; Ward, T.; Grand, P.; Enge, H. (Brookhaven National Lab., Upton, NY, USA; Massachusetts Inst. of Tech., Cambridge, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 421-425(15 Aug 1987). (CONF-860520—).

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

The RAYTRACE computer code has been modified to accept magnetic fields measured in the median plane of a dipole magnet. This modification allows one to study the effects of a nonideal dipole magnet on the beam ellipsoid. The effects on the beam ellipsoid are due to (1) field inhomogeneities in the interior region of the dipole and (2) discrepancies from design conditions of the magnetic field values in the fringe field region. The results of the RAYTRACE code calculations based on experimentally measured fields will be compared with the results derived using both an ideal (no inhomogeneities) dipole with sharp cutoff boundaries and an ideal dipole with perfect (according to design) fringe fields. (orig./HSI).

12234 **Optics modules for circular accelerator design.** Brown, K.L.; Servranckx, R.V. (Stanford Linear Accelerator Center, CA, USA; Saskatchewan Univ., Saskatoon, Canada). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 480-502(15 Aug 1987). (CONF-860520—). Contract AC03-76SF00515.

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

This paper is intended as a comparison paper to 'Circular Machine Design Techniques and Tools' presented at this conference by Roger Servranckx. The intent here is to provide a tutorial discussion on the basic optics of circular particle accelerators for the benefit of those readers who have a fundamental knowledge of charged particle optics but do not make it their profession to design particle accelerators. We begin the tutorial by presenting the solutions of the first-order differential equations of motion for a single particle in a closed circular machine introducing the concepts of phase shift, beta functions, and the Courant-Snyder invariant. From

these solutions we derive the transfer matrix between two points in the machine as a function of the phase shift and the parameters contained in the Courant-Snyder invariant. We then introduce typical optical building blocks (modules) used in circular machine designs and relate them to their characteristic transfer matrix elements, the phase shift through them, and the Courant-Snyder-Twiss parameters, β, α, and γ. Next we discuss the systematics of some elementary phase ellipse matching problems between optical modules. The report ends with a discussion of second-order optical modules and how they are used to provide the momentum bandwidth needed for the design of a typical circular machine.

12235 **Derivation of the first-order transformation matrix for a simple Wien filter and comparison to results of numerical integration.** Hurd, J.W. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 542-547(15 Aug 1987). (CONF-860520—).

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

The first-order transformation matrix is derived for a simple Wien filter. The Wien filter is approximated by square-edged, homogeneous, transverse E and B fields. The results are compared to results of numerical integration through a Wien filter with and without fringe fields. The derived transformation matrix is presently used in the first-order optics code TRACE to tune the 750 keV polarized proton injection transport at LAMPF. The Wien filter is used to precess the spin of the polarized proton beam.

12236 **Space-charge and third-order aberrations in quadrupole focusing systems.** Colton, E.P. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 566-571(15 Aug 1987). (CONF-860520—).

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

Our purpose is to consider third-order aberrations due to space charge. We derive the single-particle equations of transverse motion for a beam of elliptical cross section that propagates down a focusing channel. These equations include electric and magnetic fields caused by space charge and magnetic fields caused by quadrupoles and octupoles. We then calculate the third-order aberrations of a point-to-parallel system. We suggest that beam size should be minimized in order to control aberrations.

12237 **Some applications of particle-in-cell codes to problems of high intensity beams.** Herrmannsfeldt, W.B. (Stanford Linear Accelerator Center, CA, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 583-588(15 Aug 1987). (CONF-860520—). Contract AC03-76SF00515.

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

The technique of using the 'particle-in-cell' method was developed in the field of plasma physics [1]. Borrowed for problems of intense beams, it becomes an especially powerful tool because such problems frequently use single species 'plasmas' and so pose a less severe requirement on the computer. We will look at several problems in which the PIC code method has been useful. The first is the classical Pierce gun in a transient or short pulse mode. Here the transverse beam optics is strongly affected by the time dependence of the current. The second is a study of high power klystrons searching for the source of an instability. The third is the high power rf source called the 'lasertron' which is under development at SLAC. The interesting new development for the laserton simulation is the introduction of a double gap output cavity for improved efficiency. The lasertron and klystron simulations are steady state solutions to rf problems with high-Q cavities. In order to limit the computation to a realistic time, these simulations use an external equivalent circuit which can communicate with the beam tunnel through ports placed at the locations of the rf cavities. Application for electron beams generally require using a fully relativistic electromagnetic code such as MASK. In some applications, the computation can be speeded up by limiting the solution of the fields to the electrostatic conditions. This can be especially helpful if the degree of precision required demands very large numbers of macroparticles. As a last example, we will show the use of this technique for a problem involving emittance growth for a high intensity beam for heavy ion fusion.

12238 **Acceleration of polarized protons at the AGS.** Ratner, L.G. (Accelerator Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton, New York 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 116-123(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The methodology of accelerating polarized proton beams at the Brookhaven AGS facility is described. The whole facility can be functionally divided into two sections: the front end consisting of the polarized ion source, the 20 keV beam transport, the RFQ linear accelerator, the 750 keV beam transport, the 200 MeV linac and 200 MeV polarimeter and the 200 MeV transfer line to the AGS; and the hardware necessary in the AGS to accelerate and maintain the polarization of the injected protons. (AIP)

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 12270, 12282, 12299, 12378, 13764, 13896

12239 **(CEBAF-PR—87-030) High-frequency limit of the longitudinal impedance.** Heifets, S.A.; Kheifets, S.A. (Continuous Electron Beam Accelerator Facility, Newport News, VA (USA)). 1987. 20p. NTIS, PC A03/MF A01.

A method of iterations which takes into account finite widths of resonances is developed and used to calculate the longitudinal impedance for a cylindrical cavity with side pipes. In the high-frequency limit the dependence of the real part of the impedance on the frequency is omega sup -1/2 in agreement with estimates for average impedance obtained earlier.

12240 **(CONF-870610—16) Liquid gallium metal cooling for optical element with high heat loads.** Smither, R.K.; Forster, G.A.; Kot, C.A.; Kuzay, T.M. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003056/JAW.

From 5. national synchrotron radiation instrumentation conference; Madison, WI, USA (21 Jun 1987).

Photon beams from the insertion devices of the Argonne synchrotron facility (APS) have very high total powers, which in some cases will exceed 10 kW, spread over a few cm^2. These high heat loads require special cooling methods to keep them from degrading the quality of the photon beam. A set of finite element analysis calculations were made in three dimensions to determine the temperature distributions and thermal stresses in a single crystal of silicon with heat loads of 2 kW to 20 kW. Different geometric arrangements and different cooling fluids (water, gallium, oil, Na, etc.) were considered. The two best fluids for room temperature operation were found to be water and liquid gallium metal. The variation in temperature across the face of the crystal and the distortion of the surface was at least a factor of two less for the gallium cooling case than for the water cooling case. The water cooling was effective only for very high flow rates. Efficient cooling and the very low vapor pressure for liquid gallium (less than 10^{-13} Torr at 100°C) make liquid gallium a very attractive cooling fluid for high vacuum synchrotron applications. A small electromagnetic induction pump for liquid Ga was built to test this cooling method. The new system is portable, controls the output temperature of the Ga and can handle heat loads of 10 kW. 13 figs.

12241 **(EFI—924(75)-86) Measurement of accelerated electron beam current at the Erevan synchrotron.** Martirosyan, V.A.; Martirosyan, G.A.; Nazaryan, Yu.R.; Nikogosyan, V.Ts.; Sadoyan, K.A.; Simonyan, Kh.A.; Khachikyan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700966/JAW.

A system which ensures high accuracy of accelerated electro n beam current measurement at the synchrotron is described. The expected limits for the frequency characteristic of the measured

magnitude, i.e. current of accelerated electron beam, are analyzed. A structure of measurement devices ensuring a necessary frecuency range for measured signals is chosen. A magnetoinduction feedback converter operating in aperiodic mode is taken as a primary beam current monitor. The parameters of the converter with a coincidence amplifier were calculated with a computer. Oscillograms of accelerated electron beam current corresponding to different operational modes of the synchrotron are presented. 4 refs.; 4 figs.

12242 **(EFI—927(78)-86) Use of high-power generator lamps in nonstandard regimes.** Baryshev, A.I.; Kovalenko, V.I. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700967/JAW.

The possibility and expediency of using high-power generator lamps operating in nonstandard regimes in high-frequency power supply systems of charged particles accelerators is shown. As such the GU-53A continuously operating tethrode is used in pulsed regime at higher frequencies and the GUU27A-1 pulsed triode operates in longer pulse regime with low duty ratios. 8 res.; 3 tabs.

12243 **(FNAL-TM—1497) Residual radioactivity measurements along the PB target pile.** Cossairt, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1987. Contract AC02-76CH03000. 8p. (CONF-8710233—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003967/JAW.

From Meeting of the task force on radioactivation at the SSC; Berkeley, CA, USA (1 Oct 1987).

In this brief note, measurements of residual radioactivity made along the PB target pile will be described. This was done as a test of the methods described by P. Gollon (Go76) for predicting such radioactivity based upon surface star density calculations using CASIM. These methods have been extensively used at Fermilab, especially in the design of the Tevatron II target piles. 4 refs., 2 figs.

12244 **(FNAL-TM—1498) Radioactivation considerations for the HEB [High Energy Booster] test beams and beam absorbers.** Cossairt, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1987. Contract AC02-76CH03000. 6p. (CONF-8710233—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003965/JAW.

From Meeting of the task force on radioactivation at the SSC; Berkeley, CA, USA (1 Oct 1987).

The primary locations of radioactivation in the High Energy Booster will be the beam absorbers and in the target-beam dump assembly used for producing the test beams. The purpose of this note will be to make preliminary estimates of the radioactivation of the components of these systems. These will be based, primarily, upon experience gained in the design of Tevatron components. 1 fig., 1 tab.

12245 **(FNAL-TM—1501) Estimates of the radioactivity produced in the proposed SSC [superconductivity super collider] beam absorbers.** Cossairt, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1987. Contract AC02-76CH03000. 19p. (CONF-8710233—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003964/JAW.

From Meeting of the task force on radioactivation at the SSC; Berkeley, CA, USA (1 Oct 1987).

This paper reviews in some detail personnel exposure rates which will be encountered when the time comes for the decommissioning of the Superconducting Super Collider beam dump absorbers. Discussed are estimates for the total radioactivity content of the graphite core and for residual absorbed dose rates at the surface of the core, the steel container, and the inner surface of the concrete shielding. 10 refs., 10 figs. (LSP)

12246 **(INIS-mf—11084, pp 39) NAC neutron therapy system.** Jones, D.T.L. (Council for Scientific and Industrial Research, Faure, South Africa. National Accelerator Centre). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12247 **(INIS-SU—431, pp 406) Device for remote control of target replacement in a vacuum chamber.** Khalin, N.F. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12248 **(INIS-SU—431, pp 407) Energy spread in particle beam of the modernized NIIYaF MGU electrostatic accelerator.** Dzagurov, O.B.; Eremin, N.V.; Krivolap, V.V.; Sirotinin, E.I.; Strizhov, V.F. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12249 **(INIS-SU—431, pp 557) Experimental studying the possibilities of neutron flux control for the problems of neutron activation analysis in a microtron.** Sikora, D.I.; Ryabinichev, S.P.; Stets, M.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12250 **(JINR—9-87-81) High-frequency accelerating system in the superconducting model synchrotron.** Blinnikov, N.N.; Brovko, O.I.; Mikhajlov, A.I. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701129/JAW.

The HF accelerating system at the superconducting model synchrotron SPIN with operating modulation within 0.1 upto 5.2 MHz frequency band is described. The choice of optimum ion acceleration variant within the mass to charge ratio from 1 upto 34 is based. The block diagram, basic units of the main electronics units and accelerating station are described. 3 refs.; 2 figs.

12251 **(JINR—9-87-223) Parameters choosing of the beam injection system into the adhezator of the collective accelerator.** Aleksandrov, V.S.; Kazarinov, N.Yu.; Nefed'ev, V.O.; Shcheulin, A.S.; Shchinov, B.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701131/JAW.

The possibility of one-turn close to matched injection is considered. It is shown that by selection of electromagnetic field gradient in corrector the beam emittance growth in the course of phase stirring without stringent requirements covering on the cross-section profile of the injected beam can be minimized. The shape of the corrector high-voltage electrode permitting to obtain the necessary gradient value is found. The capture factor dependence on the corrector field gradient is calculated with help of the large particles method. The capture factor achieves 90% for chosen form of the electrode. It is shown that analytical estimations using the distribution function moments method and numerical calculations by large particles method are in satisfactorily agreement with one another. 9 res.; 9 figs.

12252 **(JINR—13-87-108) Resonance property investigation of the KUTO adhezator chamber.** Aleksakhin, Yu.I.; Gavrilova, Z.G.; Obukhov, Yu.L.; Cheremukhin, A.E.; Shcheulin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701133/JAW.

The calculation and measurement results of the natural frequency E-mode spectrum of the metallic vacuum adgezator chamber of the collective accelerator with electron rings in the frequency region upto 1.1 GHz are given. The chamber has spherical side

walls, toroidal shell and central opening. Theoretical and experimental values of frequencies differ by not more than 5%. It is shown that azimuthal asymmetry of the chamber, that is conditioned by branch pipes on its toridal surface, leads to the removal of polarized degeneracy of all azimuthally asymmetrical models and to the shift of HF-fields centre. The resonance properties of the injection devices are investigated. The measured values of Q-factors correspond to stable rings with particle number N/sub e/ ≈ 8x10/ sup 12/. 6 refs.; 10 figs.; 1 tab.

12253 **(JINR-R—9-87-171) Stretching of the accelerated beam of the JINR phasotron by means of C-electrode.** Glazov, A.A.; Zaplatin, E.N.; Kochkin, V.A. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701177/JAW.

Using an additional high-frequency element-a C-electrode-permits to get practically time continuous beam extracted from the phasotron. The results of first experiments on beam stretching showed that the coefficient of beam capture by C-electrode is 50% when the beam covers the whole acting time of the C-electrode program. The accelerating voltage on C-electrode is (10-15) kV. 4 refs.; 8 figs.

12254 **(JINR-R—10-87-163) System for measuring parameters of electron beams injected into collective heavy ion accelerator.** Azorskij, N.I.; Dolbilov, G.V.; Lebedev, N.I. and others. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701181/JAW.

The description of automation system for measurement of the intensive nanosecond electron beam characteristics of a collective heavy ion accelerator at JINR is presented. The system includes a set of the collector sensors for registering electronics for all sensors. The range of beam measured currents reaches 1000 A at repetition frequency of cycles up to 50 Hz. 7 refs.; 4 figs.

12255 **(LA-UR—87-3829) ECR [electron cyclotron resonance] ion source beams for accelerator applications: Final report.** Rusnak, B.; Cornelius, W.D. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 9p. (CONF-8711107—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003168/JAW.

From International conference on ECR ion sources and their applications; East Lansing, MI, USA (16 Nov 1987).

Reliable, easily operated ion sources are always in demand for accelerator applications. This paper reports on a systematic study of ion-beam characterisrtics and optimization of beam quality for production of light ion beams in an ECR ion source. Of particular interest is the optimization of beam brightness (defined as ion current divided by the square of the emittance), which is typically used as a figure-of-merit for accelerator-quality beams. Other areas to be discussed include the measurement of beam emittance values, the effects of various source parameters on emittances, and scaling effects from operating the same ECR source at different frequencies. 4 refs., 4 figs.

12256 **(SLAC-PUB—4335) The numerical simulation of accelerator components.** Herrmannsfeldt, W.B.; Hanerfeld, H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1987. Contract AC03-76SF00515. 26p. (CONF-8706238—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87011597/JAW.

From IEEE minicourse on computer application in plasma science; Washington, DC, USA (3 Jun 1987).

The techniques of the numerical simulation of plasmas can be readily applied to problems in accelerator physics. Because the problems usually involve a single component "plasma," and times that are at most, a few plasma oscillation periods, it is frequently possible to make very good simulations with relatively modest computation resources. We will discuss the methods and illustrate them with several examples. One of the more powerful techniques of understanding the motion of charged particles is to view computer-generated motion pictures. We will show several little movie strips to illustrate the discussions. The examples will be drawn from the application areas of Heavy Ion Fusion, electron-positron linear colliders and injectors for free-electron lasers. 13 refs., 10 figs., 2 tabs.

12257 **Ion sourcery for isotope separators.** Shubaly, M.R. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 195-203(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

To assist in the technology transfer from the field of high-current accelerator sources to isotope separators, advances in three areas are described. First, the design of extraction electrodes to provide high-quality, high-current beams is discussed. Then, two new ion-source designs for high-current beams of nonvolatile elements are described. Finally, two electronic systems that have significantly improved the reliability of ion-beam system are presented.

12258 **Measurement of the beam energy spread from a microwave ion source.** Chamberlin, E.P.; Bibeau, R.A.; Stice, R.L.; Kelley, G.M.; Wilson, J.; Leung, K.N.; Walthers, S. (Los Alamos National Lab., NM, USA; Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 227-234(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A 2.45 GHz microwave ion source has been tested on the Los Alamos National Laboratory 55/sup 0/ isotope separator. The advantages of the traditional RF ion source (high ionization efficiency and low gas consumption) are retained. In none of the tests was there evidence of energy spread resulting from the oscillatory field.

12259 **New high-temperature plasma ion source for the TRISTAN ISOL facility.** Piotrowski, A.; Gill, R.L.; McDonald, D.C. (Brookhaven National Lab., Upton, NY, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 249-252(May 1987). (CONF-860815—). Contract AC02-76CH00016.

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A vigorous program of ion-source development at TRISTAN has led to several types of ion sources that are especially suited to extended operation at a reactor-based ISOL facility. The latest of these is a high-temperature plasma ion source in which a 5-g /sup 235/U target is located in the cathode and can be heated to 2500/sup 0/C. The ion source has a lifetime of >1000 h and produces a wide array of elements, including palladium. Off-line investigations indicate that the source functions primarily in an electron impact mode of ionization and exhibits typical ionization efficiencies of >30% for xenon.

12260 **Performance of the reaction-product transport line associated with the TOFI spectrometer.** Vaziri, K.; Wohn, F.K.; Vieira, D.J.; Wouters, J.M.; Wollnik, H. (Utah State Univ., Logan, USA; Ames Lab., IA, USA; Los Alamos National Lab., NM, USA; Giessen Univ., Germany, F.R.). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 280-285(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A reaction-product transport line with a solid-angle acceptance of 2.8 msr and a momentum-to-charge acceptance of 28% has been constructed to deliver neutron-rich nuclei produced in heavy-target fragmentation reactions to the time-of-flight isochronous (TOFI) spectrometer. The design and performance of the transport line, which incorporates a mass-to-charge filter to reduce the rate of uninteresting ions entering the spectrometer, is described.

12261 **Ion-source development at the /sup 252/Cf ISOL facility.** Anderl, R.A.; Cole, J.D.; Greenwood, R.C. (Idaho National Engineering Lab., Idaho Falls, USA; EG and G Idaho, Inc., Idaho Falls, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* 26: No. 1-3, 333-340(May 1987). (CONF-860815—). Contract AC07-76ID01570.

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

The ISOL system at the INEL utilizes the He-gas-jet technique to transport fission products from /sup 252/Cf spontaneous-fission sources to the ion source of an electromagnetic mass separator. A long-lived, gas-jet-coupled ion source for production of rare-earth, fission-product ion beams has been developed and implemented in this system. This paper describes the ion source, its operating parameters and its implementation in the search for new rare-earth element isotopes. New isotopes observed, with preliminary values of their half-lives in parentheses, are /sup 153/Pr (4.2 s), /sup 155/Nd (8.9 s), /sup 156/Nd (5.5 s), /sup 157/Pm (10.9 s), /sup 158/Pm (4.3 s) and /sup 162/Eu (11.0 s). Total separation efficiencies (based on the ratio of radionuclide activity collected at the focal plane of the mass separator to radionuclide activity generated by the /sup 252/Cf source) were estimated to be approximately 1% for /sup 154/Pm and 1% for /sup 158/Sm.

12262 **Optimization of a He-jet activity transport system to use at LAMPF.** Talbert, W.L. Jr.; Bunker, M.E.; Starner, J.W. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* 26: No. 1-3, 345-350(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

Also published as report LA-UR--86-3034; CONF-860815--2.

As part of an assessment of the feasibility for a He-jet coupled on-line mass separator at LAMPF, we have studied performance characteristics of a gas activity transport system under conditions simulating those expected on the main LAMPF beam line. In experiments utilizing a side beam at LAMPF, we have measured absolute transport efficiencies, transit times, aerosol properties, and dependences on beam intensity. Further experiments with a He-jet system at the Omega West Reactor have indicated an optimum configuration of a target chamber to be placed in the LAMPF main beam. The results of these studies suggest that a He-jet activity transport system should work well at LAMPF in the 800-MeV, 1-mA proton beam that is spread over ≈ 40 cm/sup 2/ near the beam stop.

12263 **Soft X-ray scanning microscopy: its practical use for elemental mapping at the NSLS U15 beamline.** Jacobsen, C.; Kenney, J.M.; Kirz, J.; McNulty, I.; Rosser, R.J.; Cinotti, F.; Rarback, H.; Shu, D. (State Univ. of New York, Stony Brook, USA. Dept. of Physics; Brookhaven National Lab., Upton, NY, USA). *Photochemistry and Photobiology;* 44: No. 3, 421-423(Sep 1986). (CONF-8510268—). Contract AC02-76CH00016.

From United States-Japan joint seminar on ultraviolet photobiology and spectroscopy; Upton, NY, USA (2 Oct 1985).

Scanning soft X-ray microscopy offers several advantages over other forms of X-ray microscopy. It subjects the specimen to the lower doses of radiation and by digitally recording the image, gives direct quantitative information on the absorption of the specimen as a function of position. Elemental maps can be produced easily by comparing images taken at different wavelengths, chosen to exploit X-ray absorption edges or resonances. This technique was used to explore the distribution of calcium in 0.2 μm-thick bone specimens, detecting concentrations of 5% by weight, with a spatial resolution of 0.2 μm. Progress in X-ray sources in the form of undulators and in X-ray optics indicates that soon the range of elements that can be mapped will be extended and the spatial resolution and elemental sensitivity will be improved by an order of magnitude.

12264 **Data filtering - Acquisition group report of the hardware subgroup.** Cooper, P.S.; Dunlea, J.; Kasha, H.; Klein, S.; Morse, W.M.; Paffrath, L.; Sheaff, M. (Yale Univ., Dept. of Physics, P.O. Box 6666, New Haven, CT 06511). pp 200-210 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The hardware subgroup took as its charge the study of the front end electronics for a 4π SSC detector. The author presents here a feasibility study for such a readout including a conceptual worst case design. They conclude that within the assumptions enumerated below such a readout system is feasible with electronics and systems which are either presently available or are likely to become available within the next few years. The cost of such a design is non-trivial (—100$/channel x 10/sup 6/ channels), but for this exercise no attempt at economy was made. Two conclusions can be drawn from this exercise. First, that such a system is feasible with the electronic technology likely to be available when SSC detectors are built. Also, that unoptimized cost estimates of 100 $/channeel for 10/sup 6/ channels (100 M$) are not out of scale for detectors which are likely to be five times the size of present-day collider detectors and thus five times the cost (250 M$).

12265 **Summary of working group V, data acquisition and filtering subgroups B (models) and C (software).** Arai, Y.; Carroll, T.; Cutts, D.; Devlin, T.; Fortney, L.; Hedin, D.; Van Ingen, C.; Kunz, P.; Sippach, W. (Brown Univ., Providence, RI). pp 211-215 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

Others in Working Group V have considered specific applications to the problems of data acquisition for the SSC, either from the hardware direction, coping with the data at the point where it enter the system, or from the system point of view. In this paper the authors' agreed that the microprocessor "farm" was the appropriate structure from the high level data acquisition event filter. It was clear that to make effective use of the processing power in this farm, the software filter strategy must be carefully planned. It was felt that modelling of the entire detector data flow, including the acquisition system, was an activity vital to the success of a SSC experiment.

12266 **Fast trigger processor for VENUS detector of Tristan experiment.** Ohsugi, T. (Dept. of Physics, Hiroshima Univ., Hiroshima 730). pp 163-184 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

Fast look-up table processors of track finding and of the first level trigger decision have been developed for the VENUS detector. Both of them are key components of the VENUS trigger to achieve deadtimeless trigger. Even for the SSC experiment, the fast look-up table processor could be a quite powerful tool for the first and the second level trigger. It will be indispensable particularly for prompt track recognition.

12267 **Software filter strategies.** Hedin, D. (SUNY-Stony Brook, Stony Brook, NY 11794). pp 251-253 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

At an SSC luminosity of 10/sup 33/, the hardware triggers should lower the event rate to a few kHz. A farm of microprocessors can then be used to further reduce the rate to the 1 Hz level. This paper uses the proposed DO filter strategy as an example of what as SSC software filter could look like. A sketch of the current DO software filter design is given with a detailed example of the muon trigger. The hardware trigger will have imposed cuts on various trigger 'components' (e.g. muon rho/sub t/, total E/sub T/, number of jets). The first step is to recalculate each of those components which passed the hardware level but with an improved resolution due to utilizing more information (calibration constants, corrections, muon drift tube times). The various trigger components can then be correlated. Next, specified regions in other detector subsystems can be inspected. Again, an electron trigger should have a singly ionizing track approximately pointing to it. The processing time to do complete central tracking analysis is prohibitive but tracking only around the 'electron' can be done. Finally, all components can be used to classify and reject events. Those events which pass this point can then have a complete analysis performed on them.

12268 **Overview of data filtering/acquisition for a 4π detector at the SSC.** Lankford, A.J.; Dubois, G.P. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). pp 185-199 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—). Contract AC03-76SF00515.

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The difficult or new problems for data acquisition and filtering posed by a large detector at the SSC include: buffering large amounts of data for large numbers of event candidates during trigger processing, even during the fastest possible analog trigger decisions, preprocessing and reducing the complex waveform samples that will be required to separate signals of events from different beam crossings, transferring large amounts of data, effectively reducing the trigger rate by orders of magnitude using software filters, managing very large arrays of processors, both in a processor farm and embedded in detector electronics, and reducing, rather than increasing, the large offline computing load presented by the vast amount of data. The solutions to these problems seem feasible; however, developments in a number of areas are necessary to realize the solutions. These developments are described in this article.

4304 Storage Rings

REFER ALSO TO CITATION(S) 12206, 12207, 12209, 12216

12269 **Longitudinal dynamics in storage rings.** Colton, E.P. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research;* **258**: No. 3, 508-514(15 Aug 1987). (CONF-860520—).

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

We derive the single-particle equations of motion for charged particles in a storage ring. Longitudinal space charge is included in the potential assuming an infinitely conducting circular beam pipe with a distributed inductance. The framework uses Hamilton's equations with the canonical variables PHI and W. The Twiss parameters for longitudinal motion are also defined for the small amplitude synchrotron oscillations. The space-charge Hamiltonian is calculated for both parabolic bunches and 'matched' bunches. We also give a brief analysis that includes second-harmonic rf contributions. In the final sections, we calculate dynamical quantities and particle simulations with the space-charge effects neglected.

12270 **Prospect of polarized targets in electron rings.** Holt, R.J. (Argonne National Laboratory, Argonne, IL 60439). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 499-509(15 Nov 1984). (CONF-8405193—). Contract W-31-109-ENG-38.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The feasibility of performing electron scattering experiments with polarized targets in electron storage rings is discussed. Three examples of the physics which would be accessible with this novel method are given. It is noted that this new method is compatible with recent proposals for linac-stretcher-ring accelerator designs. A new method for producing a polarized hydrogen or deuterium target is proposed and some preliminary results are described. A brief summary of laser-driven polarized targets as well as conventionally-produced polarized atomic beams is included.

44 INSTRUMENTATION

12271 **(DOE/NBM—8001403) Technology for US industry from Department of Energy national laboratories: R and D Laboratory Technology Transfer Program.** (USDOE Office of Energy Research, Washington, DC. Laboratory Management Div.). Sep 1987. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001403/JAW.

This compilation contains a fact sheet on each of the 1987 IR-100 award-winning technologies, including a description of the technology and its advantages. The status of pertinent patents is given, including any licensing data. The potential uses and possible spinoff applications for the technology also are indicated, along with a contact for additional information. (JDH)

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 11152, 11630, 11958, 11964, 12062, 12063, 12264, 12265, 12266, 12267, 12268, 12644, 12679, 12680, 12973, 13018, 13019, 13028, 13080, 13161, 13265, 13479, 13896

12272 **(AD-A—185439/7/XAB) Fabricate, calibrate, and test a dosimeter for integration into the CRRES (combined release and radiation effects satellite) satellite. Technical report.** Morel, P.R.; Hanser, F.A.; Sellers, B.; Cohen, R. (Panametrics, Inc., Waltham, MA (USA)). Jun 1987. 34p. (SCIENTIFIC—4). NTIS, PC A03/MF A01.

A space-radiation dosimeter was fabricated, calibrated , and tested, and will be integrated into the CRRES spacecraft. This dosimeter is essentially identical to that previously designed, fabricated, calibrated, tested, and integrated into the DMSP F7 satellite. These dosimeters are primarily designed to measure the dose from electrons of greater than 1 MeV to greater than 10 MeV in four channels. Each channel has a different-thickness aluminum dome. The solid-state detector outputs are processed to provide the dose from electrons (low energy loss), the dose from protons (high energy loss), the flux from electrons, the flux of protons, and the rate of high-energy-loss nuclear-star events. The dosimeter also has a calibration mode in which the alpha particles from a weak source behind each detector are used to check for total detector depletion and proper operation of the electronics. A high-energy electron fluxmeter to measure electrons from 1-10 MeV in ten differential channels will also be integrated into the CRRES spacecraft. The fluxmeter will be modified to provide a low voltage continuous bias to the solid-state detectors to reduce the possibility of detector degradation in storage and in vacuum. The fluxmeter will be retested as necessary, and then be delivered and integrated into the CRRES spacecraft.

12273 (CEBAF-PR—87-029) Present status of the high resolution spectrometers. Mougey, J. (Continuous Electron Beam Accelerator Facility, Newport News, VA (USA)). 1987. 25p. NTIS, PC A03/MF A01.

Although much work is still to be done, both on spectrometer optics and in design optimization of the magnetic elements, the high resolution spectrometers are gradually taking shape. The optics designs are going to be frozen by the end of September, and the main concepts for the design of the magnetic elements should be defined by the end of the year. Choice of the best scenario for out-of-plane experiments, extended target capability, and use of polarized targets will be extensively discussed during the 1987 Summer Study Meeting.

12274 (CERN-EP—87-110) Coherent neutrino-nucleus elastic scattering in ultralow-temperature calorimetric detectors. Niinikoski, T.O.; Rijllart, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 23 Jun 1987. 10p. (CONF-8703176—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88900054/JAW.

From Workshop on low temperature detectors for low energy neutrinos and dark matter; Munich, F.R. Germany (12 Mar 1987).

We speculate on the measurement of the coherent forward peak in the neutrino-nucleus elastic scattering, using ultralow-temperature calorimetric techniques for the determination of the recoil energies down to below 1 keV. The detector would consist of an array of relatively large single-crystal calorimeters made of various elements and compounds, cooled to below 100 mK temperature. The detector should be surrounded by veto track detectors for the elimination of the background events due to cosmic rays and neutrons and charged beam particles. The coherent event rate for some existing or projected neutrino beams and sources is calculated for a Ge detector.

12275 (CIEMAT—599) Chemical and colour quenching in liquid scintillation counting. Grau Malonda, A.; Scott Guilleard, P.E. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1986. 27p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701254/JAW.

Chemical and colour quenching for H-3 and C-14 was studied. The method includes spectral analysis of colouring agents; methyl red (4'-dimethylamine-azobenzene 2-carboxilic acid) dimethyl yellow (4'-dimethylamine-azobenzene) and melachite green (metane, bis (4'-dimethyl aminophenyl)-(phenyl)). External standard channels ratio was applied for the liquid scintillation counting of samples. The introduction of an isolated external standard seems to be a strong tool for the correction of chemical and colour quenching curves. (author). 10 figs., 12 refs.

12276 (CONF-871006—8) Data acquisition for the HILI [Heavy Ion Light Ion] detector. Teh, K.M.; Shapira, D.; McConnell, J.W.; Kim, H.; Novotny, R. (Joint Inst. for Heavy Ion Research, Oak Ridge, TN (USA); Oak Ridge National Lab., TN (USA); Giessen Univ. (Germany, F.R.). II Physics Inst.). 1987. Contract AS05-76ER04936;AC05-84OR21400. 5p. NTIS, PC A02. Order Number DE88002309/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

A large acceptance, multi-segmented detector system capable of the simultaneous detection of heavy and light ions has been constructed. The heavy ions are detected with a segmented gas ionization chamber and a multiwire proportional counter while the light ions are detected with a 192 element plastic phoswich hodoscope. Processing the large number of signals is accomplished through a combination of CAMAC and FASTBUS modules and preprocessors, and a Host minicomputer. Details of the data acquisition system and the reasons for adopting a dual standards system are discussed. In addition, a technique for processing signals from an individual hodoscope detector is presented. 4 refs., 3 figs.

12277 (DOE/ER/03130—25-06/85) Data acquisition for the D0 experiment. Cutts, D.; Hoftun, J.S.; Johnson, C.R.; Zeller, R.T.; Trojak, T.; Van Berg, R. (Brown Univ., Providence, RI (USA). Dept. of Physics; Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 24 Jun 1985. Contract AC02-76ER03130. 5p. (COO—3130TC-25; CONF-8506157—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE87014482/JAW.

From Conference on computing in high energy physics; Amsterdam, Netherlands (25 Jun 1985).

We describe the acquisition system for the D0 experiment at Fermilab, focusing primarily on the second level, which is based on a large parallel array of MicroVAX-II's. In this design data flows from the detector readout crates at a maximum rate of 320 Mbytes/sec into dual-port memories associated with one selected processor in which a VAXELIN based program performs the filter analysis of a complete event.

12278 (DOE/ER/40039—17) High energy physics program at Texas A & M University: Annual report, April 1, 1987 to March 31, 1988. Webb, R.C.; McIntyre, P.M.; DiBitonto, D.D. (Texas A and M Univ., College Station (USA). Dept. of Physics). Nov 1987. Contract AS05-81ER40039. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003332/JAW.

During the past twelve months our group has continued to reach new milestones in our various research initiatives. The most notable of these was the successful completion of the first data taking run of the Collider Detector at Fermilab (CDF) in the spring of 1987. This run produced an integrated luminosity of 35 nb^{-1} at a peak center-of-mass energy of 1.8 TeV. Later in the year our group successfully concluded the chamber construction for the Forward Hadron Calorimeter system for CDF. This task was completed on schedule and under budget and was the last element of the detector to be completed. In addition to these activities, our group has also been making preparations for the mounting of the electronics for the first MACRO module presently being installed in the completed Gran Sasso experimental hall B. Further, as part of an effort to instrument the very forward region in the CDF experiment, we have been developing a small angle calorimeter for this purpose. 15 refs., 21 figs.

12279 (DOE/ER/40207—2) Streamer chamber and calorimeter measurements in relativistic heavy ion research: Progress in research. Wolf, K.L. (Texas A and M Univ., College Station (USA)). 2 Oct 1987. Contract AS05-85ER40207. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003437/JAW.

The first major section of this paper deals with streamer chamber research which is in its final year. The computerized tracking features work well for relatively simple heavy ion events, with multiplicities of 20 and lower, but for future research with very heavy ions and higher bombarding energies the projective geometry is prohibitive. The new area of research using calorimetry takes the opposite approach, in measurements of energy without the need of individual particle resolution. A preliminary experiment was conducted with the E814 collaboration during the spring of 1987 using 10 GeV/nucleon protons and heavy ions on targets of Al, Cu and Pb. The transverse energy distributions are essentially identical for Pb and Cu targets at the high energy end (central collisions), while a significant difference can be seen compared to the Al target. The interpretation is believed to be simply that Cu stops a Si nucleus equally well as a heavier Pb nucleus, i.e., complete stopping of the matter occurs already for the Cu target. A comparison at the .01 barn level for the three targets, compared to a HIJET simulation including the geometry of the calorimeter is given, which clearly demonstrates that finite acceptance is not a complicating factor. The layout of the E814 experiment is shown in the second section of this report. The participant calorimeter will be a 20 ton lead-scintillator sampling device and is in the construction phase at LANL in collaboration with TAMU. A GEANT geometry file output shows the scale of this detector.

12280 **(EFI—933(84)-86) Bayes identification of cosmic hadrons registered by XTR detector of the PION installation.** Avakyan, V.V.; Matevosyan, V.Kh.; Chilingaryan, A.A.; Chilingaryan, N.S. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/ MF A01. Order Number TI88700971/JAW.

Soft-and-hard complex constructed for automated processing of experimental data at the PION installation is discribed. Results of cosmic hadron classification by Bayes decision rules being an effective tool of combination of a priori and experimental information are reported. 6 refs.

12281 **(EFI—940(91)-86) On nonparametrical methods of nuclear cascade background suppresion in measurements of muon spectrum by means of meter.** Arutyunyan, S.Kh.; Kokoulin, R.P.; Chilingaryan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700976/JAW.

A new nonparametrical method to identify events of nuclear muon interaction in the problem of measuring muon spectrum by means of a multi-row detecting device of a pairmeter type is suggested. The method is based on the cluster analysis approach revealling characterizing structures. The method pretends on the most entire scope of distrinctive information available in a succcession of passage vector componets, such as amount of energy release in each row and shape of energy release distribution function along the device length. 6 refs.; 7 figs.

12282 **(EFI—944(95)-86) Semiconductor detectors of nuclear radiations, their fabrication and use in expriments in Erevan electron synchrotron.** Ajvazyan, G.M.; Akhverdyan, Eh.A.; Badalyan, G.V.; Erityan, G.N.; Zograbyan, G.G.; Esayan, G.V. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700979/JAW.

A short review and the main peculiarities of manufacturing semiconducor detectors are given. The problems of functional tests and characteristics of the detectors as well as the results obtained in the Erevan Physics Institute are considered in detail. The basic experiments held in the Erevan Electron Synchrotron using various semiconductor detectors are listed andanalyzed. Silicon semiconducor detectors, both surface-barier and lithium-drift ones, are shown to be succesafully used for specrometry and identification of protons, deuterons and heavier particles under hard experimental conditions in the internal beam of a high-energy electron synchrotron. 18 refs.; 3 figs.

12283 **(IA—1429) Electrical and optical properties of Hg/sub 1-x/Cd/sub x/Te doped layers grown by Liquid Phase Epitaxy (LPE).** Sarusi, G. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). May 1987. 116p. (In Hebrew). NTIS (US Sales Only), PC A06/ MF A01. Order Number TI88701023/JAW.

Contains an annotated bibliography of 39 references.

Liquid Phase Epitaxy (LPE) layers were doped during growth. The growth method was horizontal sliding in semiclosed hydrogen atmosphere. The dopants were copper for p-type layers and gallium for n-type layers.The Two Carrier Model was employed to analyse the results. By this analysis, hole concentration and mobility and electron concentration and mobility were obtained. The transmission infrared spectrum of these layers was examined in the range of 2μ to 25μ. It was demonstrated that the control of the type and carrier concentration can be achieved by doping during growth.Possible application of this work is the ability of production of p-n heterojunctions during growth.The effect of shift in λco to short wavelengths by Burstein Shift can be used as intrinsic infra-red windows. The strong dependence of reflection on wavelengths and carrier concentration demonstrated in this work, can be used in development of infrared waveguides.

12284 **(IAE—4368/14) STOIK ideal-crystal three-axis neutron spectrometer.** Naumov, I.V.; Petushkov, S.A.; Podurets, K.M.; Somenkov, V.A.; Tyugin, A.B.; Shil'shtejn, S.Sh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 24p. (In Russian). NTIS (US Sales Only), PC A02/ MF A01. Order Number TI88701036/JAW.

On-line ideal crystal three-axis neutron spectrometer is described. The spectrometer is installed in the IAE IR-8 reactor. Optical scheme of the spectrometer is presented. Analyzer and detector are located on two consoles on the sample axis and the detector is balanced by counterweight. Monochromator protection comprises mobile and immobile parts. Goniometer, analyzer unit, angular position measurement system, scanning mechanism, adjustment tables. SNM-31 helium counters are used as neutron detectos. Control and recording system of the spectrometer is constructed on the basis of the CAMAC equipment using the "Ehlektronika-60" microcomputer. Results of certification and adjustment of the spectrometer mechanical part are presented. It is shown that the device developed permits of conduct a large number of experiments both on elastic and inelastic scattering of neutrons on ideal crystals. 16 refs.; 24 figs.

12285 **(IFVE-OEF—86-230) Large drift chambers for SFINKS facility.** Erin, S.V.; Konstantinov, A.S.; Myalitsin, V.K.; Chujko, B.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701297/JAW.

Submitted to the journal Instrum. Exp. Tech. .

Two types of large drift chambers with a distributed potential for SFINKS experiment with sensitive area of 1x2 m are described. The design peculiarities of the chambers are compared. The test results are presented. 24 refs.; 3 figs.

12286 **(IFVE-OEF—87-92) Characteristics of proportional chambers with wire and continous cathodes.** Viktorov, V.A.; Kurshetsov, V.F.; Novozhilov, Yu.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701298/JAW.

The construction of proportional chambers with 960x448 mm area of electrodes and the mixture based on argon with methylal is described. The construction of chambers permits to change a wire cathode for a solid one with graphite or aluminium coating without special modification. Investigations of chamber characteristics with solid and wire cathodes as well as different diameters of anode wires have been carried out using collimated /sup 90/Sr β-source. The results bench tests show that proportional chambers with the solid cathode and anode made of a wire of a larger diameter are optimal according to their characteristics. Mean efficiency of single particle detection by means of such a chamber is 9.3%. 6 refs.; 2 figs.

12287 **(IFVE-ONF—87-93) IHEP drift chamber system used in the IHEP-JINR neutrino detector.** Bozhko, N.I.; Borisov, A.A.; Bulgakov, N.K. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701300/JAW.

Drift chamber system designed for determining track coordinates of charged particles is described. The detecting system consists of 358 chambers of 4x0.5 m dimension. A drift chamber has four signal wires with +-0.75 mm transverse shift and two drift gaps of 250 mm length. The chamber is filled with Ar+6%CO/sub 2/ gaseous mixture. Drift chamber signals come initially to shapers-amplifiers and then to time-to-digital conversion unit. Drift chamber characteristics were measured by means of cosmic muons. Chamber efficiency constitutes about 82% on the average. Coordinate resolution equals 3.5 mm for chambers surrounded with magnets and 1.4 mm - for all others. 3 refs.; 6 figs.

12288 **(IFVE-ORI—87-66) Charged particle (δE-E)-spectrometer in mixed radiation field behind biological shield of high energy accelerators.** Peleshko, V.N.; Rastsvetalov, Ya.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701301/JAW.

The design of charged particle spectrometer is described and its performances are presented. The method for 20-350 MeV proton identification at the background of other charged particles is provided. The effect of substance of the first detector and spectrometer on the whole on the number of particles detected is studied. The procedure of charged particle fluence determination is considered. Technique for the spectrometer calibration and proton spectrum determination are given. The spectrometer permits to identify 20-350 MeV protons, low energy level of detection is equal (9.2+-0.5) MeV for pions (8.0+-0.5) MeV for muons, (1.1+-0.1) MeV for electrons. 10 refs.; 9 figs.

12289 **(INFN-LNF—87-19(P)) Calibration of an anisotropic neutron detector.** Rindi, A.; Miozzi, S.; Celani, F. (Istituto Nazionale di Fisica Nucleare, Frascati, Italy. Lab. Nazionale di Frascati). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701064/JAW.

To be submitted to Nucl. Instrument. Methods.

The neutron flux in the underground facilities of the Gran Sasso International Laboratory in Italy which is being built for experiments in high energy physics and other research fields shall be measured. Theoretical calculations show that the flux should range between some 10/sup -7/ and 10/sup -6/n cm/sup -2/ s/sup -1/ and will be isotropic. The very sensitive large long counters which will be used for measuring the fast neutron component are very asymmetric and their calibration for operating in an isotropic neutron flux presents some peculiar problems. A semiempirical method for calculating the sensitivity of one or more asymmetric long counter to be used in an isotropic neutron field is described. From an empirical equation which indicates the angular variation of the sensitivuty of a single counter, we derive and experimentally verify the expression for the angular variation of several counters operated in parallel. This is used for finding the sensitivity constant for operation in an isotropic field.

12290 **(INFN-LNF—87-80-(P)) Plastic spark counters with PVC electrodes.** Battistoni, G.; Campana, P.; Denni, U.; Gustavino, C.; Iarocci, E. (Istituto Nazionale di Fisica Nucleare, Frascati, Italy. Lab. Nazionale di Frascati). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701067/JAW.

To be submitted to Nucl. Instrum. Methods.

The performance of a spark counter based on plasticized PVC is described. The relevant features of this detector match the requirements of surface and underground cosmic ray experiments. Its technological characteristics allow large area detector construction.

12291 **(INFN-LNF—87-89(R)) Response of streamer tubes to higly ionizing particles.** Battistoni, G.; Bloise, C.; Liberatori, L.; Satta, L. (Istituto Nazionale di Fisica Nucleare, Frascati, Italy. Lab. Nazionale di Frascati). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701069/JAW.

To be submitted to Nucl. Instrum. Methods.

The charge response of streamer tubes has been measured as a function of ionization power by exposure to relativistic ions. The results are discussed in view of the use of streamer tubes in the search for magnetic monopoles.

12292 **(INIS-mf—10794) Development and test of a high-resolution drift chamber in cylindrical geometry.** Hawelka, P. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 25 May 1987. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88751922/JAW.

In the present thesis a prototype of a cylindrical-symmetric drift chamber is presented which fulfills extensively the physical and geometrical requirements of the vertex chamber of the L3 experiment. This prototype is constructed with small annulus-shapedly arranged drift cells. In our case a drift-cell-cross section of 10x15 mm/sup 2/ for the 13 internal rings respectively 14x21 mm/sup 2/ for the 12 external rings was selected. The drift cells exhibit a radial drift field and are bordered by few cathode wires so that the wire distances do not fall below 5 to 10 mm. Therefore signal wire lengths of 1 m and more can be reached. The position-measurement accuracy of the drift chamber was experimentally determined with an electron beam (4GeV/c). By means of these tracks the drift cells are calibrated with fixed reference chambers; in comparison with this the position-drift-time relation is only determined from the displacements of the cells. Both calibrations are applied to the calculation of the drift cell resolutions. In the r,phi plane comparable spatial resolutions of 30 μm at 1 bar and 25 μm at 2 bar gas pressure are obtained in a mean drift-path range between 3 and 10 mm. The measurement accuracy of the z coordinate is mainly determined by the stereo angles of the cells. From the test data at atmospheric pressure results a mean z-resolution of 1.3 mm for the 10x15 mm/sup 2/ large cells and 1.0 mm for the 14x21 mm/sup 2/ cells. (orig./HSI).

12293 **(INIS-mf—11051) Interekotechnika '86. Symposium proceedings.** (Incheba, Bratislava (Czechoslovakia)). 1986. 37p. (In English, German, Russian, Czech and Slovak). (CONF-8606367—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700806/JAW.

From Symposium on interekotechnika; Bratislava, Czechoslovakia (25 Jun 1986).

The symposium with international participation was focused on two subject areas, viz.: (1) measuring methods and instruments for testing chemical quality of the basic components of the environment; (2) technologies and installations with minimal environmental impact. The proceedings contain the texts of 15 submitted papers of which 2 were processed for INIS. (A.K.).

12294 (INIS-mf—11051, pp 16-33) **Remote control and environment monitoring systems for nuclear power plants and nuclear installations.** Nemecek, P. (Laboratorium Prof. Dr. Berthold, Wildbad, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700806/JAW. (CONF-8606367—).

From Symposium on interekotechnika; Bratislava, Czechoslovakia (25 Jun 1986).

An overview is presented of methods and instruments for remote control and monitoring of radioactive emissions from nuclear power plants and other nuclear installations, and for monitoring concentrations of radioactivity and local dose rates in the vicinity of such installations. The necessary measurement ranges and instrument detection limits are reported for the individual quantities subject to monitoring, and examples of appropriate instruments are given. For emissions, the radioactivity is monitored of rare gases, iodine and aerosols. The results of the monitoring are processed electronically and transferred by remote control onto the central station. For the local dose rate measurement, 10 to 30 measuring stations are established in the vicinity of nuclear installations provided with GM counters, proportional counters or ionization chambers. The measured data are transferred via leased lines or telephone lines to the central station. The concentrations of radioactive iodine and aerosols are usually monitored using equipment with a moving filter band and a scintillation counter whose data is also transferred to the central station. The simple data stations usually consist of a display monitor, a printer and a flopy disk memory. For measuring network at a national level, large computers are used which also provide calculations of the spread of radioactivity and issue commands for the declaration of population protection alarm. (A.K.).

12295 (INIS-mf—11059-Vol.11-No.1, pp 42-47) **Semiconductor-diode-aided dosimetry of the irradiation of pourable bulk material.** Gruenewald, T.; Rudolf, M. (Bundesforschungsanstalt fuer Ernaehrung, Karlsruhe, Germany, F.R. Inst. fuer Verfahrentechnik). Apr 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700808/JAW.

Hard copies are available from Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.

In Food Irradiation Newsletter. Vol. 11, No. 1.

The irradiation of unpackaged pourable bulk material requires the employment of a dosimeter which can be readily transported along with the material. Planar diffused silicon diodes have been found to be suitable for this purpose. To date these have been used solely for the purpose of dose rate measurements; however, it can be shown that the permanent change in reverse recover time at the p-n junction correlates with the absorbed irradiation dose in the range up to 10 kGy. Appropriate selection of the diode and thermal treatment lead to a linear dependence and enable the silicon dosimeter to be reused. (author). 16 refs, 4 figs.

12296 (INIS-mf—11063) **Efficiency study of a high resolution gamma-ray spectrometer.** Marti Climent, J.M. (Universidad Autonoma de Barcelona (Spain). Facultad de Ciencias). 1987. 127p. (In Spanish). NTIS (US Sales Only), PC A07/MF A01. Order Number TI88701077/JAW.

A review of the different curves for the efficiency fit of a high resolution gamma-ray spectrometer was made. These curves are used to fit the efficiency of our detector system. In order to study the goodness of the different fits various standards were used, and the ICRP GAM-83 exercise results were employed. (author).

12297 (INIS-mf—11084, pp 39) **Selection of a collimator for a mobile scintillation camera suitable for optimum imaging of In-III.** Geldenhuys, E.M.; Loetter, M.G.; Minnaar, P.C. (University of the Orange Free State, Bloemfontein, South Africa. Dept. of Biophysics). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12298 (INIS-mf—11608) **Digital image evaluation for the determination of morphometric sizes for periodontal X-ray diagnosis and selective coronary angiography.** Barth, K. (Stuttgart Univ. (Germany, F.R.). Fakultaet 4 - Elektrotechnik). 12 Nov 1982. 155p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number TI88751933/JAW.

In its uses in the areas of periodontology and coronary angiography it is shown, how the digital image evaluation expands the possibilities of x-ray diagnosis and how it improves the objectivity and exactness of the evaluation. For the accomplishment of this task a detailed analysis of the morphological data is undertaken. The results of the analysis lead to a mathematical structure model. Based on this model the recognition and measuring of the object in an adaptive heuristic process is undertaken. In this case it dealt with a desmodontal split, whose change is indicated by a periodontal bone atrophy. The contour recognition is embedded in a newly created image processing system, which allows itself to be used generally and is shown using the presentation of coronary vessels as an example. The exactness of the automatic image evaluation in comparison to the measuring done by the doctor is discussed. (orig./TRV).

12299 (INIS-SU—3/1) **Millimeter wavelength ultralow temperature magnetic radiospectrometer.** Vertij, A.A.; Zvyagina, G.A.; Ivanchenko, I.V. and others. (AN Ukrainskoj SSR, Kharkov. Inst. Radiofiziki i Ehlektroniki). 1986. 36p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701088/JAW.

The paper deals with the superlowtemperature radiospectrometric complex designed for investigation of substances in the temperature range from 4.2 to 0.3 K. The obtaining of superlow temperatures - 0.3 K is carried out in the circulation regime of /sup 3/He. As resonance spectrometer cells it is suggested and investigated some variants allowing to obtain high sensitivity and resolution of the spectrometer, as well as minimum heat flow into the working chamber. The absorption spectra have been obtained of the HMBACrV substance designed for polarized nuclear targets at the frequencies of 75 and 150 GHz in the temperature ranges from 4.2 to 0.7 K. 14 refs.; 19 figs.

12300 (INIS-SU—431, pp 588) **Radiation level indicators on the base of photodiodes.** Bogatov, V.N.; Kovtun, V.E.; Nagajchenko, V.I.; Cherkasov, A.S.; Shevchenko, A.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12301 (INIS-SU—431, pp 249) **Evaluation of study possibilities of /sup 100/Mo 2β-decay by means of semiconductor and scintillation detectors.** Vasilenko, V.V.; Zdesenko, Yu.G.; Kostezh, A.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12302 (INIS-SU—431, pp 404) **Use of an ionization chamber with two grids for spectroscopy of protons in the (n,p) reaction with slow neutrons.** Gledenov, Yu.M.; Kvitkova, N.I.; Mitrikov, M.P.; Mitrikova, R.S.; Tishin, V.G.; Fung Van Zuan. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12303 (INIS-SU—431, pp 409) **Technique of recoil spectrometry.** Gorpinich, O.K.; Kondrat'ev, S.N.; Prokopenko, V.S.; Rakitin, S.B.; Sklyarenko, V.D.; Tokarevskij, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12304 (INIS-SU—431, pp 411) **Measuring and calculating complex for determining the total cross sections of neutron interactions with nuclei.** Burmistrov, Yu.M.; Grigor'eva, T.E.; Molodtsov, Eh.D. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12305 (INIS-SU—431, pp 416) **Device for searching the events of delayed neutron multiple emission.** Avdeev, S.P.; Vasilenko, A.T.; Karnaukhov, V.A.; Kuznetsov, V.D.; Myshinskij, G.V.; Petrov, L.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12306 (INIS-SU—431, pp 418) **Identification of the form of heavy product mass distribution in binary reactions by means of thin-film dielectric breakdown detectors.** Gorshkov, I.Yu.; Smirnov, A.N.; Ehjsmont, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12307 (INIS-SU—431, pp 533) **Measuring and calculating the efficiency of neutron detectors on the base of stilbene and NE213.** Konfederatenko, V.I.; Lashchenov, B.V.; Maznyj, I.A.; Maksimov, Yu.K.; Nagornaya, L.L.; Povoroznik, O.M.; Struzhko, B.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12308 (INIS-SU—431, pp 534) **Detection of high-energy γ quanta by scintillation spectrometer on the base of CdWO/sub 4/.** Eremin, N.V.; Nagornaya, L.L.; Spasskij, A.V.; Shakhvorostova, G.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12309 (INIS-SU—431, pp 535) **Automated γ spectrometer on the base of the Ehlektronika NMS 11100.1 microcomputer.** Vishnevskij, I.N.; Zerkin, V.V.; Lobach, Yu.N.; Sidorenko, V.A.; Tkachuk, I.P.; Trishin, V.V.; Churakov, A.K. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12310 (INIS-SU—431, pp 538) **Multi-computer complex for spectrometry.** Brudanin, V.B.; Vakhtel', V.M.; Gorozhankin, V.M.; Rybak, K.S.; Chernyak, A.Yu.; Chumin, V.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12311 (INIS-SU—431, pp 539) **First methodical measurements using the YaSNAPP-2 multi-detector correlation installation.** Abrosimov, V.N.; Adam, I.; Vagner, V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12312 (INIS-SU—431, pp 545) **Ultrasonic channeling of charge pulse slow component in silicon MDS-detectors of nuclear radiation.** Zaveryukhin, B.N.; Krevchik, V.D.; Muminov, R.A.; Ehgamov, Sh.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12313 (INIS-SU—431, pp 546) **Acoustically stimulated mode of α-spectrometry by silicon MDS-detectors with the second channel of charge losses.** Zaveryukhin, B.N.; Krevchik, V.D.; Muminov, R.A.; Ehgamov, Sh.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12314 (INIS-SU—431, pp 553) **On the possibility of /sup 166m/Ho use for calibration of semiconductor γ spectrometers.** Konstantinov, A.A.; Kurenkov, N.V.; Malinin, A.B.; Sazonova, T.E.; Sehpman, S.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12315 (INIS-SU—431, pp 561) **γ radiation spectra processing on the base of Kalman adaptive filter.** Novikov, A.I.; Stolyarov, E.L.; Savel'ev, I.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12316 (INIS-SU—431, pp 565) **Direct γ spectroscopy of /sup 237/Pu in a thick target irradiated by helium-3.** Nosov, A.A.; Pelevin, L.A.; Gedeonov, A.D.; Dmitriev, V.D. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12317 (INIS-SU—431, pp 566) **Spectrometric characteristics of photomultipliers on the base of microchannel plates.** Ajnbund, M.P.; Ivanov, A.I.; Isaakyan, G.A.; Uchevatkin, I.F.; Fominenko, A.V.; Frolov, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12318 (INIS-SU—431, pp 568) **CdWO/sub 4/, ZnWO/sub 4/, CaWO/sub 4/ monocrystals and search for neutrinoless 2β-decay.** Cherkasov, A.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12319 (INIS-SU—431, pp 569) **Use of qualitative in the problems of identification of elemental composition.** Stets, M.V.; Sikora, D.I.; Ryabinichev, S.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12320 (INIS-SU—431, pp 574) **BFITIM system for complex electron spectra processing.** Pas'ko, A.A.; Pilyugin, V.V.; Pokrovskij, V.N.; Prostakov, I.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12321 (INIS-SU—431, pp 581) **Calibration of a neutron detector with organic scintillator.** Voronova, N.A.; Korsakov, D.B.; Matyukov, A.V.; Chugunov, I.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12322 (INIS-SU—431, pp 405) **PEhGAS multimodule 4π spectrometer of γ quanta, neutrons and charged particles.** Kamanin, V.V.; Kugler, A.; Kuznetsov, A.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12323 (INIS-SU—431, pp 414) **Identification of light charged particles and γ quanta in heavy ion reactions by means of CsI(Tl).** Kamanin, V.V.; Kugler, A.; Sobolev, Yu.G.; Fomichev, A.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12334 (INIS-SU—431, pp 532) **System for studying performances of proportional chambers.** Gafarov, A.A.; Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pirogov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12335 (INIS-SU—431, pp 541) **Resolution of scintillation γ cameras with coding collimators in radiation spatial modulation.** Fedorov, G.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12336 (INIS-SU—431, pp 551) **Fluctuations of charge induced by majority and minority carriers in semiconductor detectors with p-n junction.** Samedov, V.V.; Stolyarova, E.L. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12337 (INIS-SU—431, pp 562) **γ radiation scintillation detectors on the base of wideband fluorides combined with herringbone assemblies of microchannel plates.** Gussar, V.A.; Grudskij, M.Ya.; Rejterov, V.M.; Rodnyj, P.A.; Sinev, A.N.; Smirnov, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12338 (INIS-SU—431, pp 563) **α-counter with a large solid angle for absolute measurements.** Voronin, A.S.; Lahaev, S.I.; Solov'ev, S.M.; Soloshenkov, P.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12339 (INIS-SU—431, pp 570) **Simulation of γ detection in scintillation detectors by the Monte Carlo method.** Kugler, A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12340 (INIS-SU—431, pp 577) **N-γ-identificator with overlapping rejector.** Matyukov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12341 (INIS-SU—431, pp 582) **Dead layers of Si-surface barrier detectors.** Bajzakov, B.B.; Lim, D.; Dzhurnev, U.B.; Khasanov, D.K. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12342 (INIS-SU—431, pp 586) **Study on radiometric characteristics of the Si(Au) photodetector-plastic scintillator system.** Kugatova, F.U.; Muminov, R.A.; Ryakhovskaya, T.I.; Fedorovskij, Yu.P.; Khasanov, D.K. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12333 (INS-T—468) **Computer codes for activation data analysis, coincidence summing correction code: SUMECC, decay correction code: DECFIT.** Torii, Atsushi; Uwamino, Yoshitomo; Nakamura, Takashi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1987. 18p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751432/JAW.

Coincidence summing effects play an important role in Ge gamma-ray spectrometry at short source-to-detector distances. Absolute radioactivity measurement of nuclides emitting many cascading photons needs this correction, because the total absorption peak efficiency of gamma rays from such nuclide is sometimes lowered by 10 to 30 % if the sample is attached on the detector head. A computer program, SUMECC, was coded for this correction. A counting rate of a total absorption peak changes with time, and the existence of parent nuclides and nuclides emitting photons of very close energy which cannot be distinguished from objective photons complicate the decay curve. A computer program, DECFIT, was made for the analysis of these complicated decay data. This paper describes the conceptsof these two computer codes and their user's mannuals.

12334 (INS-T—471) **Mechanical structure of the TOPAZ barrel drift chamber.** Morimoto, T.; Maruyama, K.; Okuno, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751434/JAW.

A Barrel Drift Chamber (BDC) is constructed for the TOPAZ experiment at TRISTAN, KEK. The BDC has a cylindrical shape with dimensions of 325.2 cm in inner diameter, 347.2 cm in outer diameter and 500 cm long. It consists of 1232 drift tubes made of conductive plastic cathodes, which are staggered in four layers. In this report, a design of the mechanical structure and construction procedures are described in detail.

12335 (INS-T—472) **High-voltage system for the TOPAZ inner drift chamber.** Shiino, Kazuo. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1987. 24p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751435/JAW.

A high-voltage system for the TOPAZ Inner Drift Chamber (TOPAZ-IDC) is described. In the experiment at the colliding beam accelerator, high voltages to the drift chambers have to be carefully controlled in order to avoid the damage to the anode wires caused by the excess current due to the intense background radiation at the injection and acceleration periods. This system is designed to supply high voltages (1.8 kV) to the 1,024 anode wires of the IDC, which can be controlled mannually or by the computer system through the CAMAC channel. The system has been operated reliably at the TRISTAN-TOPAZ experiment which started in May 1987.

12336 (INT—183/I) **Neon-helium-nitrogen gas mixtures for X-rays proportional counters.** Othman, A. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701361/JAW.

Satisfactory neon based three component gas mixture for X-rays proportional counters is reported. Measurements on some Ne + He + N/sub 2/ mixtures show that these mixtures exhibit energy resolution about 17% for Mn K line (5,9 keV), energy resolution plateau length of about 300 volt, small count rate effect and possibility to achieve gas amplification factor up to 10/sup 4/.

12337 (ITEF—4(1987)) **MIG-1 on-line measuring holographic microscope.** Aleshin, Yu.D.; Goncharov, V.A.; Karlov, T.D. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701103/JAW.

Design and main technical parameters of MIG-1 automated holographic microscope are described. Microscope permits to measure events of elementary particles detected and holographically reconstructed. The design takes into account peculiarities of focuced

image extra-axial holography. Microscope control is automated by "Ehlectronica-60" computer. MIG-I is designed on the basis of UIM-23 instrumental microscope mounted on a 2000x1000 mm bench plate with film-pulling mechanism and laser. Specially developed third measuring carriage with vertical movement is added to UIM-23 two horizontal measuring carriages. 9 refs.; 3 figs.

12338 **(ITEF—12(1987)) Focused image holography aberrations.** Mel'nichenko, I.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701105/JAW.

At present for operation at new constructing tevatron-accelerators holographic recording methods are developed for 15-foot Fermilab chamber, for BEBC chamber in CERN, for one-meter holographic bubble chamber of Tokio University. Theoretical and experimental study of focused image holography (FIH) aberrations is carried out, the values of admissible parameters of restoration, in which range aberrations do not deteriorate resolution on reconstructed image of the object, are determined. It is shown that in focused image holography (FIH) diagram oberrations are absent at reconstructed image, if while recording reconstructing beam wave length is equal to that of reference beam, and the first beam is equal to the second conjugated. FIH lenses aberrations may be insignificant if reconstruction parameters in certain limits are equal to that of recording process. 6 refs.; 1 fig.

12339 **(ITEF—13(1987)) Possibility to search for double beta decay by means of nuclear emulsions.** Barabash, A.S.; Bolozdynya, A.I.; Egorov, O.K.; Kolganova, Eh.D.; Pozharova, E.A.; Skorod'ko, T.Yu.; Smirnitskij, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701106/JAW.

Description of a technique for search for neutrinoless 2β $2\beta(O\nu)$ and $2\beta(2\nu)$ decay is given. It is shown that 2β decay search for may be performed by means of nuclear emulsions practically for all interesting isotopes with sensitivity to ~ 10/sup 22/ year half life for $O\nu$ modes and ~ 10/sup 21/ years for 2ν mode. Increase of the photoemulsion scanning rate will permit to improve the method sensitivity. 23 refs.

12340 **(ITEF—23(1987)) Trigger possibilities of a transition radiation detector.** Artamonov, A.A.; Ganzhinov, A.M.; Gorbunov, P.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701108/JAW.

Possibilities of organizing fast (upto 500 ns) trigger based on transition radiation detector are studied. Investigaions are carried out on one detector module (radiator plus proportional chamber) with parallel flash ADC. Proportional chamber has three electrodes. Distance between cathode and anode planes is 7.5 mm (gas gap length is 15 mm), gas impurity -90%Xe+10% CO/sub 2/. The data were obtained separately in electron and pion beams, at 3 GeV/c momentum. Several flowsheets are considered. The best result is obtained using the suggested method of measuring time for which proportional chamber current signal exceeds the assigned threshold. 3 refs.; 11 figs.

12341 **(ITEF—32(1987)) Electron identification and energy measuring with xenon bubble chamber.** Barylov, V.G.; Demidov, V.S.; Demidova, A.M.; Nikitenko, A.N.; Shebanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701112/JAW.

Criteria of reliable identification of electron and positron tracks in a xenon bubble chamber are formulated, an algorithm to calculate their energies using the results of measurement of the full length of particle tracks of the shower produced by an electron and potential depth of shower development is suggested. 10 refs.; 8 figs.; 1 tab.

12342 **(ITEF—103(1986)) On the electron emission from liquid isooctane.** Bolozdynya, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701116/JAW.

Known experimental data on exoelectron emission from liquid isooctane an ionization chamber are analysed using electron capture by acceptors. It is shown that exoelectron emission from liquid isooctane at the room temperature has threshold character and E/sub 0/ threshold value is 170+-20 V/cm. Emission probability is equal 1 at E > E/sub 0/. Experimentally observed emission factors depend on exoelectrons lifetime in the liquid; lifetime is limited by an electron capture by electronegative impurities. Dependence of an emission time from electric field is obtained. 3 refs.; 3 figs.

12343 **(ITEF—172(1986)) Exoelectron emission from condensed krypton and other nonpolar dielectrics.** Bolozdynya, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701118/JAW.

Exoelectron emission from liquid and solid krypton has been investigated. It is shown that emission has the threshould character. The critical emission electric field E/sub 0/ is equal to 1600 and 980 V/cm in liquid and solid krypton respectivelly. The hot electron emission probability is equal to ~ 1 at E>E/sub 0/, and <10/sup -2/ at E<E/sub 0/. E/sub 0/ does not depend on thickness of a dielectric layer. The typical emission time is less than 10/sup -7/s. The temperature dependence of the emission threshould E/sub 0/ has been determined for the temperature range 95-145 K. The experimental results are analysed together with the data on the electron emission from liquid isoctane, liquid n-hexane and condensed argon, krypton, xenon and methane. It has been concluded that the emission has thermionic character. 24 refs.; 8 figs.; 1 tab.

12344 **(JINR—12-87-173) Preparation of silver bromide and manufacturing crystal silver bromide detectors.** Lomova, L.A.; Bradnova, V.; Nevzorova, N.M.; Bogdanov, S.A. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of High Energy; Radievyj Inst., Leningrad, USSR). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 40p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701132/JAW.

One of the possible methods of increasing the sensitivity of track detectors by replacement of AgCl with AgBr is presented. The method of preparaion of pure AgBr equally alloyed with cadmium is briefly described. The methods used to control the purity of the obtained raw material are shown. The construction of AgBr detectors and the estimate of their sensitivity to protons, α-particles and relativistic nucei are described. The results of this work are given. 5 refs.; 2 figs.

12345 **(JINR—13-87-150) Identification and spectrometry of low-energy charged particles using the ionization chamber with two grids.** Gledenov, Yu.M.; Kvitkova, N.I.; Mitrikov, M.P.; Mitrikova, R.S.; Tishin, V.G.; Fung Van Zuan. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701134/JAW.

Submitted to the journal Prib. Tekh. Ehksp. .

The technique using an ionization chamber with two grids for identification and spectrometry of low-energy charged particles with similar energy but different values of their mass and charge product is described. The two-sectional plane ionization chamber (IC) comprises two identical IC with a common electrode; a target for the investigated reaction is placed on the one side and a gauge target on the other side of the electrode surface. IC grids are wound of a tungsten filament 100 μm in diameter at 2 mm pitch. Ar+3.5% CO/sub 2/ servesas a working gas. The technique permits to carry out multidimensional measurements of coinciding pulses from the cathode and anode of the ionization chamber. The selection circuit provides reliable identification of different type

charged particles with similar energy and essential improvement of the effect/background ratio under bag energy resolution due to absence of a radioactive target in the chamber. The technique was applied for investigation of (n, p) reactions with slow neutrons for / sup 7/Be, /sup 36/Cl, /sup 88/Y radioactive targets. 11 refs.; 3 figs.

12346 **(JINR—13-87-240) Device for the study of relativistic particle and nuclear interaction with extended targets.** Gusakov, Yu.V.; Makarov, L.G.; D'yachenko, V.M. and others. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of High Energy; Moskovskij Gosudarstvennyj Univ., USSR). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701136/JAW.

A multichannel device used to carry out experiments at the Dubna synchrophasotron for the purpose of studying the passage of relativistic particles and nuclei through extended targets is described. The distinguishing characteristics of this device is the use of a hodoscope as secondary particles detectors. The hodoscope consists of 50 KNT-8 ionization chambers and activated detectors placed in the target volume. Their position can be varied depending on experimental tasks. The device operates on-line with a MERA-60 computer. A CAMAC system is used for transmitting commands and data storage from the remote apparatus. 25 refs.; 3 figs.; 1 tab.

12347 **(JINR—13-87-248) Scintillation and track technique to search for 2 β/sup 2ν/-decay.** Akimov, Yu.K.; Govorov, A.M.; Do Khoang Kyong and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701137/JAW.

Scintillation technique for searching the double β-decay in film sources is considered. Comparison of scintillation spectrometer detection efficiencies, obtained by different authors, is conducted. Data on electron multiple scattering in the source material are presented. Electron-positron pair angular distribution and possibility of sufficient pair discrimination by introducing the scattering threshold angle are shown. Variant of a facility with scinitillation counters and wire chambers is presented. Time-of-flight technique for suppressing the background from electrons, produced in scintillators, is used. The facility will allow one to conduct the search for 2β/sup 2ν/-decay under ~ 2x10/sup 20/ year half-life. 15 refs.; 2 figs.

12348 **(JINR—16-87-228) Counting response of neutron detection channel based on the corona SNM-14 counter.** Gromov, V.O.; Panyushkin, V.A.; Shishkin, A.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of Radiation Safety). 1987. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701139/JAW.

The results of an investigation of the counting response of a neutron detection channel based on the corona SNM-14 counter are presented. Within the range of operating voltages from 700 to 13000 V the influence of discrimination level and of cabel length on the channel sensitivity has been studied. Information is given on the time dependence of the counting rate of the channel in the synchrocyclotron for a certain operating mode of the accelerator. From this information the dead time of the channel is derived (~ 10/sup -5/ s). The electronic circuits of the channel are described. The obtained results may be applied in choosing the conditions and operating modes for SNM-14 counters. 8 refs.; 6 figs.; 1 tab.

12349 **(JINR-D—1-87-328) Some features of streamer tube operation.** Vodop'yanov, A.S.; Golovatyuk, V.M.; Guzik, Z. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701384/JAW.

Submitted to the journal Nucl Instrum. Methods.

The characteristics of wire chambers with a metal cathode, operating in a self-quenching streamer mode, have been investigated. The mechanism of self-maintained discharge development in detectors of such a type has been found out. The influence of inaccuracies, introduced in the assembly of detectors, on their characteristics has been investigated. It is shown that the unstable operation of streamer tubes with a resistive cathode is a consequence of graphite varnishing technology. 9 refs.; 16 figs.

12350 **(JINR-R—10-87-243) Ways to advance the efficiency of the film data processing systems.** Balgansuren, Ya.; Glagolev, V.V.; Govorun, N.N.; Dirner, A.; Ivanov, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701183/JAW.

Results on development of high-automated systems for chamber film measurement results processing are generalized. The systems allow to reduce the period for an experiment data analysis by 3-4 times that has been attained at the expense of processing optimization, algorithmization of some manual operation and creation on this basis of a series routines. It allowed to transposit most of all laboured operations to the computer. 18 refs.; 1 fig.

12351 **(JINR-R—10-87-266) Iterative codes and their application in systems for event registration in multichannel charged particle detectors.** Nikityuk, N.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701388/JAW.

Submitted to the journal Instrum Exp. Tech. .

Questions on the use of iterative codes for data registration in hodoscopic systems are considered. The method of construction and properties of the most interesting codes from the practical point of view are considered. These codes can be used to construct effective coding circuits applicable to the systems which have a large number of registration channels (more than one hundred). Examples of the construction of coding circuits for a large number of inputs are given. A long-term application of the iterative codes for the creation of trigger systems used for spectrometers-calorimeters is considered. Efficiency on the use of the iterative codes depending on the number of registration channels is discussed. 16 refs.; 12 figs.; 1 tab.

12352 **(JINR-R—11-87-234) Fast and economical algorithms for special-purpose processors used in high-energy physics spectrometers. Sign logarithms residue system.** Nikityuk, N.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701389/JAW.

Two fast and economical algorithms are described which can be effectively used for the construction of special purpose processors for high-energy physics spectrometers: sign logarithms and a residue system. The characteristics property of the sign logarithms is the possibility of executing addition and substraction operations of the logarithms of numbers and the possibility of presenting numbers with negative sign. The operations addition, substraction and multiplication over whole numbers are carried out in the residue system very fast, without spending time for transfer between digits of numbers. Both, not well-known, number systems have the advantage that they are effectively executed by the table method with the help of PROM. For this purpose special tables made by computer are created for the execution of arithmetical operations over 12-digits binary numbers. Several examples which illustrate the efficiency of the considered algorithms are given. 29 refs.; 4 figs.; 4 tabs.

12353 **(JINR-R—13-87-169) Measuring technique of coordinates of the origin and of the end of particle track in the mesooptical Fourier transform microscope.** Soroko, L.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701186/JAW.

The properties of the mesooptical images of the straight line particle track originated and (or) ended within the field of view of the Mesooptical Fourier-Transform Microscope (MFTM) are studied. The features of the mesooptical images of the particle track the length of which is smaller than the diameter of the field of view of the MFTM are presented. To evaluate the coordinates of the origin and of the end of the straight line particle track by means of its left

and right mesooptical images, a new measuring algorithm is suggested. The error of these measuremets which depends upon the straight line particle track length is analysed. 5 refs.; 5 figs.

12354 **(JINR-R—13-87-170) Measuring technique of small scattering angles and decay length in the mesooptical Fourier-transform microscope.** Soroko, L.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701187/JAW.

The mesooptical analogue of the moire effect observed in the Mesooptical Fourier-Transform Microscope (MFTM) for nuclear emulsion is described and its features are presented. The properties of the left as well as the rigth mesooptical images of the straight line particle tracks which fall in the field of view of the MFTM are deal. The new measuring technique of small scattering angles and of decay length which is based on the mesooptical analogue of the moire effect is suggested. It is shown that the measuring process of small scattering angles is reduced to the evaluation at the output of the MFTM of only one quantity-the relative displacement of the mesooptical images of two particle tracks which form "kink" or "fork" events. The aligning processes of two straight particle tracks as well as computer processing of the intermediate results of measurements inherent to the traditional measuring technique of small scattering angles are completely eliminated in the suggested technique. It is noted that the minimal scattering angle which can be measured with new technique presented in this work amounts to about one angular minute. 8 res.; 13 figs.

12355 **(KAERC—702/86) On the improvement of characteristics of the gamma-ray compensated neutron ionization chamber (1) - Sensitivity to neutron -.** Han Chang Hi; Son Yong Gang; Kim Jong Yon. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). 10 Oct 1986. 5p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701393/JAW.

Two types of the gamma-ray compensated ionization chambers with high-sensitivity to neutron have been designed for neutron flux measurement in reactor. The optimal values of structure factors have been determined, and sorts and pressure of the filling gas have been selected and determined reasonably. Consequently, its sensitivity to thermal neutron has been raised several times without increasing the sensitive volume.

12356 **(KFK—4291) Evaluation of high-rate pulse processing in K-edge densitometry.** Eberle, H.; Matussek, P.; Michel-Piper, I.; Ottmar, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Aug 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88751941/JAW.

Different pulse processing systems have been tested at high counting rates for K-edge densitometry measurements with a continuous X-ray beam. The total input counting rates presented to the gamma detector have been varied between 10 kcps and 100 kcps. This paper describes the results of the measurements, in particular the influence of high counting rates on the spectral resolution, on the pile-up behaviour, on the throughput rate, and on the K-edge densitometry results.

12357 **(KFK—4298) Spectroscopy of light quark systems.** Koch, H.; Kunze, M. (Karlsruhe Univ., T.H., Germany, F.R.. Inst. fuer Experimentelle Kernphysik). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Experimentelle Kernphysik). Sep 1987. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751965/JAW.

This article is part of a proposal for the construction of a high intensity proton accelerator in Europe (EHF, Proposal for a European Hadron Facility, edited by J.F. Crawford (SIN), supported by BMFT (Germany) and INFN (Italy)). Experiments concerning the spectroscopy of light quark systems are discussed, which can be performed with kaon beams of high intensity and high purity at EHF. After a brief review of the status of meson- and baryon- spectroscopy an optimized detection system is presented, and two specific experiments (glue-ball production with K/sup -/ beams; radiative decays of the Λ(1405)-resonance) are discussed in detail. A Monte-Carlo-simulation shows, that clear signals for these processes can be obtained in short measuring times. These examples demonstrate, that with high quality K/sup -/ beams new and important information on hadron-spectroscopy can be obtained, which is important for a further understanding of quantum-chromo-dynamics.

12358 **(KFTI—87-27) Measurement of deuteron polarization in polarized target.** Belyaev, A.A.; Get'man, V.A.; Dzyubak, A.P. and others. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701395/JAW.

Syste for measuring deuteron polarization in polarized target representing high-sensitive NMR spectrometer, based on direct current Q-meter with serial measuring circuit, operating in on-line mode, is described. Use of short (λ/12) connecting cable and phase autotuning of the measuring circuit resonance frequency permitted to improve system sensitivity preserving the NMR signal distortions at an insignificant level. Technique for determining deuteron polarization in the target based on analysis and expansion of NMR deuteron spectrum and requiring no recording of thermal equilibrium signal is given. NMR deuteron spectrum has been analysed in 1,2 propylene glycol D/sub 8/-C/sub 3/D/sub 6/ (OD)/sub 2/ at T=0.3 K and electric field gradient tensor components V/sub αβ/ in the place of deuteron disposition for CD and OD couplings have been determined. 9 refs.; 2 figs.; 1 tab.

12359 **(KFTI—87-28) SK-600 two-gap helium streamer chamber.** Vinokurov, E.A.; Voloshchuk, V.I.; Gorbenko, E.S. and others. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701396/JAW.

Design of two-gap helium streamer chamber is described. Chamber electrodes are fabricated in the form of thin wire grids. The chamber has been investigated in the LUEh-2000 electron linac photon beam. Hardened beam intensity of electron bremsstrahlung constituted about 3x10/sup 5/ real photons per one accelerator pulse. 4 refs.; 2 figs.

12360 **(KFTI—87-31) Analytic description of peak shapes produced by semiconductor and scintillation detectors.** Kuptsov, G.N.; Nemashkalo, B.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701398/JAW.

To describe single peak shapes from semiconducting and scintillation detectors, it is suggested to use Gauss function with variable dispersion, which analytical dependence was chose in the form of hyperbola. Function simplicity and analiticity give a number of advantages as compared with expressions described in literature. High quality has been achieved in description of single peak shapes. Results of approximation of single peak shapes of Ge(Li) and NaI(Tl) detectors are given in the paper. New function contaiNs six parameters and permits to describe at high accuracy single symmetric and asymmetric peak shapes both in maximum and on its tails. It may be applied in programs of preliminary and complete analysis of complex spectra. 12 refs.; 4 figs.; 1 tab.

12361 **(LBL—23908) The two-coil toroid magnet: An option of ASTROMAG.** Green, M.A.; Basini, G.; Ricci, M.; Codino, A.; Spillantini, P.; Rosetelli, F. (Lawrence Berkeley Lab., CA (USA); Istituto Nazionale di Fisica Nucleare, Rome (Italy); Perugia Univ. (Italy); Florence Univ. (Italy); Ansaldo S.p.A., Genoa (Italy)). Sep 1987. Contract AC03-76SF00098. 8p. (CONF-870901—22). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88004447/JAW.

From 10. international conference on magnet technology (MT-10); Boston, MA, USA (21 Sep 1987).

The ASTROMAG particle astrophysics experiment for the space station requires large magnetic field integrals in order to separate high z, high energy isotopes. The two-coil toroid is a magnet configuration which can provide the desired field integral. The

two-coil toroid will produce a magnetic field with zero net dipole moment which is required for operation on the space station. Magnetic fields as high as 5 T can be generated within a useful part of the experiment using this configuration. This paper presents a low mass zero mechanical moment two-coil toroid which could be launched by the space shuttle for use on the space station. The magnet design presented in this paper will be cooled using pumped helium II at about 1.8 K. The proposed cryogenic system would operate for up to 2 years on a single load of liquid helium II. The ASTROMAG cryogenic system is designed for helium resupply from the shuttle.

12362 **(NRPB-R—209) Fading characteristics of Kodak Type-2 film under a number of temperature and relative humidity conditions. Part 1.** Milton, M.I.L.; Marshall, T.O. (National Radiological Protection Board, Chilton (UK)). Aug 1987. 9p. H.M. Stationery Office, London, price Pound 3.00.

An investigation of the stability of the latent image for the Kodak Type-2 monitoring film was carried out under various conditions of temperature and humidity. The results indicate that the Type-2 film is suitable for use for periods of up to one month for temperatures not exceeding 30/sup 0/C and relative humidities of less than 60%. The Type-2 film is not suitable for use in conditions of prolonged exposure to temperatures of greater than 30/sup 0/C and/or relative humidities of more than 60%, and under these conditions the use of an alternative method of personal monitoring (eg, TLD) is recommended. It is expected that further planned experiments will show that under normal conditions the Type-2 film may be worn for periods of up to three months. Investigations are planned into the effect of fractionated exposure to extreme environmental conditions in order to determine whether the recommended non-use of the film under these conditions may be relaxed in certain circumstances.

12363 **(PB—88-110374/XAB) NBS (National Bureau of Standards) measurement services: Fricke dosimetry in high-energy electron beams. Final report.** Soares, C.G.; Bright, E.L.; Ehrlich, M. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Jul 1987. 58p. (NBS/SP—250/4). NTIS, PC A04/MF A01.

Also available from Supt. of Docs. as SN003-003-02816-9; Library of Congress catalog card No. 87-619834.

The NBS Fricke-Dosimetry Service (advertised in NBS Special Publication 250, 1986-1988 and earlier editions) is described in detail. After a brief historical introduction and description of the service, the theoretical basis (including what quantities are measured, how, and why) and the philosophy of internal quality checks are discussed in some detail. This is followed by a description of the physical setup and of the step-by-step operating and reporting procedures. Throughout the section, there is reference to sample records of past performance, in order to facilitate continuity of operation in the case of personnel changes. The document concludes with a discussion of the uncertainties involved in the measurement quality-assurance service, safety considerations, and an appendix containing samples of all form letters and of the final report mailed to the participants.

12364 **(PSD—87, pp M1) New high precision lifetime measurements in pure copper with a BaF/sub 2/ lifetime spectrometer.** Ederhof, M.; Sager, A.; Luehr-Tanck, W.; Hehenkamp, T. (Goettingen Univ., Germany, F.R. Inst. fuer Metallphysik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

12365 **(PSD—87, pp M2) Spectrometer for study of three photon annihilation.** Georgiev, A.; Vinarov, N.; Mishev, P.; Toumbev, G. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

12366 **(PSD—87, pp M5) Positron camera with high density avalanche chambers.** Manfrass, P.; Enghardt, W.; Fromm, W.D.; Wohlfahrt, D. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

12367 **(SLAC-PUB—4405) Progress report on the SLD Cerenkov Ring Imaging Detector system.** Hallewell, G.; Ashford, V.; Bienz, T.; Bird, F.; Gaillard, M.; Kwon, Y.J.; Leith, D.; McShurley, D.; Nuttall, A.; Oxoby, G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA); California Univ., Santa Cruz (USA); California Univ., Santa Barbara (USA); Cincinnati Univ., OH (USA); Rutgers--the State Univ., New Brunswick, NJ (USA)). Sep 1987. Contract AC03-76SF00515;AT03-76ER70023. 7p. (CONF-871006—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003261/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

We report on the development of the Cherenkov Ring Imaging Detector for the SLD experiment at the SLAC Linear Collider. In particular we outline recent progress in engineering and new construction techniques which will greatly simplify the manufacture of the 40 quartz window drift tubes required for the barrel CRID. Progress in the preliminary design of the endcap CRID is reviewed, and the development of operating, monitoring and control systems for the complete detector is discussed. 18 refs., 11 figs., 2 tabs.

12368 **(SLAC-PUB—4453) Engineering tradeoffs in miniaturization of electronics for very large detectors.** Larsen, R.S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1987. Contract AC03-76SF00515. 4p. (CONF-871006—19). NTIS, PC A02. Order Number DE88003607/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

The trend toward Application-Specific Integrated Circuits and similar systems-on-a-chip-technologies is fueling a new wave of innovation in detector electronics, just in time to address some of the problems being introduced by detectors which will approach a million channels of electronics. The cost-effectiveness of these technologies can be easily demonstrated, and the trend of the past twenty years of achieving more powerful electronics at a lower per-channel cost should receive a major impetus. The investment required in the new technologies will reshape the work force of most laboratories, by providing more and better tools, and by requiring training or retraining of significant numbers of personnel. The need for new instrumentation standards will arise at new levels in the detectors of the future. The laboratories must also invest heavily in integrating various computer aided engineering and computer aided design tools into a smoothly functioning system. They must also establish a new and different kind of working relationship with vendors and suppliers of both basic devices as well as standard packaged products. This paper discusses three concepts.

12369 **Resolution function of a pulsed-source neutron chopper spectrometer.** Loong, C.K.; Ikeda, S.; Carpenter, J.M. (Argonne National Lab., IL, USA). *Nuclear Instruments and Methods in Physics Research;* 260: No. 2/3, 381-402(15 Oct 1987).

We introduce a formulation for the evaluation of the incident neutron intensity distribution for a chopper time-of-flight spectrometer at a pulsed neutron source. This treatment, incorporated with an assumed scattering function of the sample and the detector geometry, enables calculations of the shape of the time-of-flight intensity profiles of the incident and the scattered neutrons sensed by a neutron detector, thus providing direct comparison with experimental results. The resolution function, R(Q, E), is calculated for a nondispersive scatterer at a resonant energy E. The results of the calculations on the basis of this theory are substantiated by measured spectra obtained by the two chopper spectrometers,

HRMECS and LRMECS, at the Argonne Intense Pulsed Neutron Source under a variety of experimental conditions. In all cases we find excellent agreement between calculations and experiments. Using these results we present a procedure for the determination of the mean incident neutron energy and the calibration of the energy-transfer scale for pulsed-source chopper spectrometers. These latter do not follow accurately from simple analysis, and are the main objects of this paper.

12370 **Resolution of small-angle scattering with Soller collimation.** Mildner, D.F.R.; Carpenter, J.M. (Missouri Univ., Columbia, USA. Research Reactor Facility; Missouri Univ., Columbia, USA. Dept. of Physics; Argonne National Lab., IL, USA. Intense Pulse Neutron Source). *Journal of Applied Crystallography;* **20**: No. 5, 419-424(1 Oct 1987).

The effect of Soller collimation on the resolution characteristics of small-angle scattering spectrometers for which there is a limitation to the total length, as in the case of a pulsed source instrument, is examined. Any finite distance between the exit of the collimation and the sample position causes the resolution of the instrument to deteriorate. This results from a correlation in angle and position for points at the sample producing an extra (cross-correlation) term in the resolution function. Expressions for this general case are derived. They are similar to those when the incident beam is defined at the sample position, except that both the source and the sample contributions have an extra term which is proportional to the finite distance between the end of the incident collimation and the sample.

12371 **Time-of-flight isochronous (TOFI) spectrometer for direct mass measurements of exotic light nuclei.** Wouters, J.M.; Vieira, D.J.; Butler, G.W.; Wollnik, H.; Kraus, R.H. Jr.; Vaziri, K. (Los Alamos National Lab., NM, USA; Giessen Univ., Germany, F.R.; Clark Univ., Worcester, MA, USA; Utah State Univ., Logan, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 286-293(May 1987). (CONF-860815—).

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A new type of time-of-flight recoil spectrometer designed to measure the masses of neutron-rich light nuclei has recently been completed at LAMPF. The spectrometer relies on an isochronous design that directly correlates an ion's time-of-flight through the spectrometer with its mass-to-charge ratio. Additional measurements of the ion's velocity and energy enable the charge state of the recoil to be uniquely defined and thus permit precision mass measurements given sufficient statistics. The performance of the spectrometer has been investigated in both-off line (using alpha sources) and on-line tests. The design resolution of $\Delta M/M = 1/2000$ (fwhm) has been achieved. Initial performance results of the spectrometer are described with emphasis placed on the techniques used to achieve the overall high mass resolution and large solid angle/momentum acceptance.

12372 **Improvements to the helium-jet coupled on-line mass separator RAMA.** Bloennigen, F.B.; Moltz, D.M.; Lang, T.F.; Knoll, W.F.; Xu, X.; Hotchkis, M.A.C.; Reiff, J.E.; Cerny, J. (California Univ., Berkeley, USA. Dept. of Chemistry; Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **26**: No. 1-3, 328-332(May 1987). (CONF-860815—). Contract AC03-76SF00098.

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

Some general improvements to the on-line mass separator RAMA have yielded a factor of five increase in yield for most elements. By placing the ion-source region at the full accelerating potential of 20 kV, the effective skimmer-plasma distance has been reduced from 12 to <2 cm. Changes in the helium-jet chamber and large-volume pumping arrangement necessitated by placing the ion-source region at high voltage are also given. Finally, details for a new highly-shielded detector station are presented.

12373 **Effect of air scatter on calibration of instruments for detecting neutrons.** Eisenhauer, C.M.; Schwartz, R.B.; McCall, R.C. (National Bureau of Standards, Gaithersburg, MD, USA; Stanford Linear Accelerator Center, Menlo Park, CA, USA). *Radiation Protection Dosimetry;* **19**: No. 2, 77-84(1987).

Monte Carlo calculations of the effect of air scatter on neutron fluence from Cf, moderated Cf, Am-Be, and Am-B neutron sources are presented. Net scattered fluence ratios of 1.38 +- 0.10%, 4.40 +- 0.21%, 0.95 +- 0.10%, and 0.99 +- 0.10% per metre, respectively, are indicated. Application of these results to the calibration of neutron personnel protection instruments is discussed, and a method is given for estimating air scattering from other neutron sources.

12374 **Some observations on ^{3}He neutron spectrometry.** Evans, A.E. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **96**: No. 1-4, 1-4(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The energy resolution of a ^{3}He ionization chamber, which varies from 13 keV FWHM at O keV to approximately 30 keV at 1 MeV, allows observations of false peaks due to the presence of scattering or absorbing materials and due to accidental near-coincidences of the rather long-risetime detector pulses. Pulse-risetime distributions depend on the neutron beam's angle of incidence to the detector axis; ability to separate ^{3}He-recoil pulses from full-energy ^{3}He(n,p) pulses diminishes for neutrons of energy greater than 1.5 MeV and incident normal to the detector axis. When high-energy neutrons are present, measurement at a grazing angle is recommended.

12375 **Radiation field measurements in the TAMU irradiation cell.** Brady, M.; Parish, T.; Erdman, C. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **96**: No. 1-4, 5-8(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Recent interest in reactor safety and fusion related experiments has prompted measurements of the radiation field (neutron and gamma) in the irradiation cell at Texas AandM University's TRIGA reactor. Neutron activation techniques were used to measure fluxes at various positions in the irradiation cell.

12376 **Forward B spectroscopy at the SSC.** Lipton, R. (Physics Dept., Carnegie-Mellon Univ., Pittsburgh, PA 15213). pp 396-401 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The SSC is designed primarily as a machine to probe the 1 TeV energy regime. It should also prove to be an excellent machine for probing "low energy" (less then 100 GeV mass scale) physics. By the time the SSC is commissioned B decays will have been studied for over 5 years at LEP and the SLC. Much of the "easy" B physics will have been done. The level of mixing should be known, and experiments will have searched for CP violation. The SSC must be a site for high precision, high statistics studies of small effects such as CP violation and rare B decays. The SSC (Superconducting Super Collider) can be competitive for two reasons. First is the sheer event rate, at a luminosity of 10/sup 33/ there will be 10/sup 5/ B pairs produced per second. Second is the prospect of high quality silicon vertex detector systems which can use the constraint of a 20μm transverse beam spot to tag tacks which do not originate from the primary vertex. In conclusion a forward detector which can detect 10/sup 8/ - 10/sup 9/ B pairs in a 10/sup 7/ sec run appears feasible. Approximately 10/sup 4/ B→ PSI K/sub s/ are expected and 10/sup 6/ dilepton pairs from BB decay. The branching ratio sensitivity for rare decays is expected to be at the 10/sup -6/ level.

12377 SSC jet spectrometer: A multipurpose detector scheme for the central region. Theodosiou, G.E. (Dept. of Physics, Univ. of Pennsylvania, Philadelphia, PA 19104). pp 415-472 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

A large acceptance specialized detector scheme is considered here, which could perform a series of measurements in the central (y=O) region. Its physics goals include the systematic study of jets, bottom-quark and lepton physics and search/study of quark-gluon plasma (QGP) and quark compositeness. The physics requirements for measurements are defined and various experimental techniques are analyzed with some emphasis on triggering requirements. On this basis a detector scheme is synthesized and various types of triggers are considered. Finally, possible measurements at a higher luminosity (L=10**34/cm**2/sec) are briefly discussed as well as R and D effort needed.

12378 Report of the high level trigger group. Abolins, M.; Dorenbosch, J.; Fukui, Y.; Hauser, J.; Kulhman, S.; Kumar, R.; Linn, S.; Lockyer, N.; Melanson, H.; Ohsugi, T. pp 131-133 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The objectives of the High Level Trigger Group were: a) A comparison of the relative merits of the analogue and digital electronics for trigger implementations. b) An examination of the implementation of specific triggers. c) Making of estimates of the effect of detector granularity on the trigger. d) Making of estimates of the effects of the high interaction rates at the SSC on the performance of these triggers. Because of limited time and manpower, the group decided to restrict itself to topics b) and d) above.

12379 Summary report for the special triggers group. Bjorken, J.D.; Slaughter, A.J. (Fermilab, Batavia, IL 60510). pp 359-362 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The charge of the special triggers group was to discuss data acquisition and triggering for everything except the generic 4π detector. Clearly this was too big a topic for a four-day workshop so topics were identified and subgroups formed based on the interests of the participants. A number of reports from the subgroups are included in the proceedings. Note that, in contrast to the situation with the generic 4π detector where the Snowmass design set limits and parameters, most of the discussions here began by defining the parameters of the detector before moving on to data acquisition. This report summarizes the conclusions of the subgroups.

12380 A jet spectrometer for SSC energies and luminosities. Bensinger, J.; Giokaris, N. (Brandeis Univ., Waltham, MA 02154). pp 377-389 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

A limited solid angle ($\Delta\theta$ = Δphi = +- 0.8 radians) spectrometer designed to study high transverse momentum (rho/sub T/) jets at SSC energies and luminosities are described. The reasoning for its overall size and the particular type of each detector component is explained. Trigger rates for two jet production, expected from QCD, as well as number of electronic channels are listed.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 10661, 10666, 10671, 10764, 11109, 11114, 11658, 11899, 11987, 12049, 12132, 12161, 12162, 12163, 13758

12381 (AERE-R—12536) Analysis of microwave reflections from imperfect dielectrics and its application to the detection of thin solvent layers. Plested, G.N.; Crellin, P.; Flemming, M.A. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Aug 1987. 35p. H.M. Stationery Office, London, price Pound 5.00.

Techniques are described for measuring thin solvent layers on an aqueous base, using microwave reflection. A theoretical analysis of reflections from an air/solvent/aqueous system is given in which the relative complex permittivities of the media are used to account for the imperfect dielectric properties of the solvent and aqueous phases. This analysis enables the magnitudes and phases of reflected and transmitted signals at the interfaces to be determined from complex Fresnel's formulae and hence predicts the magnitudes and phases of both vertically and horizontally polarized reflected components. The theoretical results are used to suggest possible techniques for measuring the thickness of a solvent layer using either the magnitude or phase information contained in the microwave reflection. A simple method for measuring the relative phase of the horizontally and vertically polarised signals, using only a scalar detector, is also described.

12382 (BARC—1343) Knudsen effusion apparatus for high temperature vaporization studies. Kerkar, A.S.; Chandrasekharaiah, M.S. (Bhabha Atomic Research Centre, Bombay, India. Water Chemistry Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701228/JAW.

The Knudsen effusion apparatus built entirely from the indigenuously available parts is working satisfactorily. The total cost of the fabrication is less than a quarter of the cost of importing a similar unit. The versatality of the unit will greatly be enhanced once the mass filter is incorporated into it. 6 refs., 8 figures.

12383 (BARC—1363) Remote controlled motor drive for hanging mercury drop electrode. Sathaye, N.S.; Kishore, K.; Moorthy, P.N. (Bhabha Atomic Research Centre, Bombay, India. Chemistry Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701245/JAW.

Construction and working of a motor drive and control unit for making reproducible mercury drops of desired size and breaking them off a Hanging Mercury Drop Electrode (HMDE) are described. The device is useful in voltammetric experiments particularly in connection with pulse radiolysis-polarography where, for safety reasons, the HMDE located close to the radiation beam from the accelerator has to be operated from a distance outside the shielded accelerator cave. The units described here, apart from the HMDE which is a standard accessory in all commercial voltammetric instruments, make use of locally available components and can be easily fabricated on the basis of the details given here. 4 figures.

12384 (CONF-870610—17) CCD [charge-coupled device] sensors in synchrotron x-ray detectors. Strauss, M.G.; Naday, I.; Sherman, I.S.; Kraimer, M.R.; Westbrook, E.M.; Zaluzec, N.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002930/JAW.

From 5. national synchrotron radiation instrumentation conference; Madison, WI, USA (21 Jun 1987).

The intense photon flux from advanced synchrotron light sources, such as the 7-GeV synchrotron being designed at Argonne, require integrating-type detectors. Charge-coupled devices (CCDs) are well suited as synchrotron x-ray detectors. When irradiated in-

directly via a phosphor followed by reducing optics, diffraction patterns of 100 cm^2 can be imaged on a 2 cm^2 CCD. With a conversion efficiency of ~1 CCD electron/x-ray photon, a peak saturation capacity of $>10^6$ x rays can be obtained. A programmable CCD controller operating at a clock frequency of 20 MHz has been developed. The readout rate is 5 x 10^6 pixels/s and the shift rate in the parallel registers is 10^6 lines/s. The test detector was evaluated in two experiments. In protein crystallography diffraction patterns have been obtained from a lysozyme crystal using a conventional rotating anode x-ray generator. Based on these results we expect to obtain at a synchrotron diffraction images at the rate of ~1 frame/s or a complete 3-dimensional data set from a single crystal in ~2 min. 16 refs., 16 figs., 2 tabs.

12385 (CONF-8706187—, pp 19-25) **GaAs/Al/sub 0.3/Ga/sub 0.7/As, heterojunction bipolar transistors for high-temperature (T > 300°C), power electronic applications.** Zipperian, T.E.; Brennan, T.M.; Hammons, B.E. (Sandia National Labs., Albuquerque, NM). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Solid-state devices formed from compound semiconductor materials like GaAs, GaP, SiC, and (Al, Ga)As have long been viewed as candidates for use in electronic circuits functioning at temperatures greater than 300°C. To address the specific needs of power semiconductor devices operating simultaneously at high currents, voltages, and high temperatures, heterojunction devices formed from combinations of GaAs and (Al,Ga)As have recently been proposed. These novel heterojunction structures display reduced resistive and voltage parasitics when compared to wide-bandgap GaP or SiC homojunction diodes without seriously compromising control of thermally generated leakage currents. In this study a prototype, low-power, (Al, Ga)As/GaAs, heterojunction bipolar transistor (HBT) is described which has demonstrated excellent electrical characteristics in the 300 to 400°C temperature range. At 350°C, the HBT has a common-emitter current gain of 14 (V/sub CE/ = 5V, I/sub C/ = 10 mA) and collector-base leakage of 6.4 x 10^{-3} A/cm^2 (V/sub CB/ = 5 V). These studies and others imply that a heterojunction, (Al Ga)As/GaAs, power semiconductor electronics technology is feasible in the near future.

12386 (CONF-8709132—3) **Laser post-ionization secondary neutral mass spectroscopy.** Gruen, D.M.; Pellin, M.J.; Calaway, W.F.; Young, C.E. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002979/JAW.

From 6. international conference on secondary ion mass spectrometry - SIMS VI; Versailles, France (13 Sep 1987).

Three different instruments using laser ionization techniques will be described. Results from the SARISA instrument with a demonstrated figure of merit of .05 (atoms detected/atoms sputtered) for resonance ionization; detection of Fe at the sub-part-per-billion level in ultrapure Si; and features of the instrument such as energy and angle refocusing time-of-flight (EARTOF) mass spectrometer and multiplexing for simultaneous detection of secondary ions and neutrals. 12 refs., 3 figs.

12387 (DP—1756) **Contained x-ray diffraction goniometer for examination of radioactive materials.** Smith, P.K.; Osgood, B.C.; Blaser, D.E.; Howell, R.E.; Stuhler, H.; Stauver, J. (Savannah River Lab., Aiken, SC (USA); Siemens Energy and Automation, Inc., Cherry Hill, NJ (USA)). Nov 1987. Contract AC09-76SR00001. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003486/JAW.

Radioactive materials are being characterized for chemical form and certain physical properties with an x-ray diffraction goniometer customized for containment in a shielded alpha glovebox. A Siemens D500 goniometer was customized by Siemens to locate the associated electronics and x-ray generator outside the glovebox to minimize corrosion and facilitate maintenance. A graphite monochromator is used with a shielded scintillation detector to separate diffracted x-radiation from nuclear radiation. The diffraction system is computer automated for data acquisition and reduction. The facility is designed to handle primarily alpha- and beta-emitting samples with moderate neutron and gamma radiation. Samples containing plutonium, enriched uranium, and other transuranic elements are analyzed in support of site nuclear operations and development programs on nuclear waste, chemical separations, reactor fuels, and product forms.

12388 (INIS-SU—431, pp 537) **Automated nuclear magnetometer.** Gumennikov, V.V.; Vakhtel', V.M.; Ivashkevich, A.S.; Chumin, V.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12389 (JINR—13-87-160) **Blocks for distribution of analog data using an isolated line of serial interface.** Zamrij, V.N.; Roganov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701135/JAW.

The blocks have been elaborated for the systems with a large number of control analog channels and with extended communication lines are described. The connection of the group of blocks with the processor is accomplished through the CAMAC interface module, serial current line and isolated optical couplers. In the addressed block the data are converted into an analog signal of the addressed channel if the conditions of format and sequence of bytes transmisson, of parity checking and protection (the polarity reverse is not permitted for large signals) are fulfilled. The blocks circuits and their operation modes are considered: RD-8 - the bytes pair transmission (addresses of 8 blocks and 8 block channels 8-bit data, sign and check bits) with a blocked count of bytes and check character; RD-12 - the 1-4 bytes transmission and return (addresses of 10 blocks and 8 channels, 12-bit data, sign) with their distinguishing and check characters identification. For the RD-8 and RD-12 blocks the time required for the transmission, distribution and remembering of data for one of the channels, for the conversion and setling of the output +-5 V signal with an accuracy of 0.4 and 0.1% is 2.1 and 8.4 ms, respectively. This is in accordance with the performances of the controlled current sources and magnetic optics elements of the linear induction accelerator. 8 refs.; 4 figs.

12390 (N—88-11609, pp vp) **Imaging interferometry with non-redundant arrays.** Zirker, J.B. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

The performance of a set of nonredundant arrays, that convert an existing telescope to an interferometer, was simulated. Each array is a perforated mask, placed at an image of the objective. Each pair of holes in a mask transmits a unique spatial frequency that is present in the target; hence the term nonredundant. Each mask produces a fringe I(f) in the focal plane that is the product of the Fourier transforms of the object and the optical transfer function S(f).

12391 (NIIAR—6(687)) **Data acquisition and processing system for a mass-spectrometer's site.** Kiselev, A.V.; Loginov, N.D.; Marusev, V.I.; Sviridova, Yu.F.; Temnoeva, T.A.; Fedorov, Yu.D. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701209/JAW.

A two-level measuring-calculating system (MCS) has been developed; BESM-6 computer is used as a central computer at the upper level, at the lower - a terminal computer of the RPT type (Videoton, Hungary). MCS is designed for: the experimental data acquisition in the RPT immediate memory from several (up to five) mass spectrometers; communication of data accumulated in BESM-6 through a communication link; mathematical processing by BESM-6 and obtaining results at the mass spectrometer region. Simultaneous and independent recording of data from a mass spectrometer group as well as communication of data accumulated in BESM-6 without disturbance of RPT operating mode are provided

with specially developed programs executed in RPT under OC RPS control. BESM-6 software is based on basic possibilities of OC RPS with respect to work with terminals. Received data is entered the archive in the form of variable length files by means of direct access programs; such archive organization permits to use the data for subsequent analysis and processing with the help of programs using any level languages. 7 refs.

12302 **(SAND—87-1851) A technique for low level, wide range CW microwave power meter calibrations.** Haushalter, R.J. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1987. Contract AC04-76DP00789. 25p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88004147/JAW.

An improved technique facilitating the calibration of CW microwave power meters at extremely low power levels and over wide ranges is presented. A 3-directional-coupler assembly is at its heart. A computer-controlled, semi-automated system that collects, stores and processes raw calibration data with hard copy output of complete calibration documentation as a final product is introduced. 5 refs., 5 figs., 1 tab.

12303 **(UCID—21241) A statistical analysis of sensor accuracy issues for strategic defense systems.** Goodman, D.M. (Lawrence Livermore National Lab., CA (USA)). 29 Oct 1987. Contract W-7405-ENG-48. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004067/JAW.

A statistical performance bound is developed for the quad cell optical tracker. This bound allows a first cut analysis of sensor requirements for a strategic defense weapon platform. The applicability of this bound to larger arrays is discussed. Finally, a brief overview of other signal processing issues for optical trackers is presented. 21 ref., 4 figs.

12304 **(UCID—21264) 5-Ghz operation of the ITT and RCA streak tubes with a 7.5-ns time window.** Lerche, R.A.; Grasz, E.L.; Griffith, R.L. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 17p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003342/JAW.

Two streak cameras, one based on the ITT F4157 streak tube and one based on the RCA C73435 image converter tube have been operated at 5-GHz with twelve input channels and a time window of 7.5 ns. Under the operating conditions used to achieve this performance, the two cameras exhibit similar characteristics. Indeed, the tubes can be substituted for each other with minor mechanical modifications to the camera body. 4 refs., 4 figs., 1 tab.

12305 **(UCID—21284) Remote fiber fluorimetry techniques for pressure measurements.** Haugen, G.R. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004486/JAW.

An optical remote sensor for temperature and pressure was constructed by affixing a ruby crystal to the tip of a single optical fiber. The temperature and pressure information is encoded onto the fluorescent signal back-scattered from the fibertip. Such an optical system is immune to electromagnetic noise. Changes in the lifetime of the emission are associated only with changes in the temperature of the ruby crystal, while frequency shifts of the emission lines are associated with both pressure and temperature changes. Measurements of frequency shifts and lifetime are not dependent on excitation beam intensity and/or losses in the optical fiber. This system will operate reliably and accurately in hostile and adverse non-isothermal environments. The sensor is able to measure pressure stresses at a minute point in a material with a resolution of a few tenths of kilobars. The dynamic range is one megabar. The doublet spacing also indicates whether the stresses are hydrostatic or non-hydrostatic. However, one disadvantage of the ruby sensor is its relatively long lifetime (3 msec at 300°K), limiting the time resolution of pressure wavefronts. Given the very favorable performance of the sensor, it would be significant improvement to develop a chromium ion activated crystal having a much faster mean lifetime. 22 refs., 6 figs., 1 tab.

12306 **Double-focusing toroidal mass spectrograph for energetic plasmas. Pt. 2. Experimental results.** Young, D.T.; Marshall, J.A.; Burch, J.L.; Booker, T.L.; Ghielmetti, A.G.; Shelley, E.G. (Los Alamos National Lab., NM, USA; Southwest Research Inst., San Antonio, TX, USA; Lockheed Palo Alto Research Labs., CA, USA). *Nuclear Instruments and Methods in Physics Research;* 258: No. 3, 304-309(15 Aug 1987). (CONF-860520—).

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

We report here on experimental results from a new toroidal ion optical system that has the potential to improve significantly the angular acceptance and sensitivity of previous satellite-borne ion mass spectrometers while retaining the focusing properties required for good mass resolution. Laboratory results with single and tandem toroids show full-width acceptances of +- 6/sup 0/ and +- 25/sup 0/ in azimuthal and vertical directions. Second-order aberrations have been measured and are compared with analytical and ray tracing results. Terms to fourth order in vertical acceptance angle and position are also found to be important. Data were obtained with an automated two-dimensional two-axis-of-motion imaging microchannel plate detector system that greatly speeds up data acquisition and analysis.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 10833

12307 **(UCID—21113) Proton precession magnetometer.** Stager, R. (Lawrence Livermore National Lab., CA (USA)). Mar 1986. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003707/JAW.

The downhole proton precession magnetometer (DPPM) is designed to make total intensity magnetic field measurements in small bore exploratory wells. This manual describes the measurement procedure and discusses maintenance issues. The step-by-step description of the measurement procedure is suitable for use by an operator of the system, while the section on maintenance procedures and theory of operation is intended for use by someone with some experience in electronics. 7 figs.

12308 **(UCID—21282) The two-loop variable-spaced induction logging tool for containment applications: Design and field results.** Harben, P.E.; Holladay, G.; Pihlman, M. (Lawrence Livermore National Lab., CA (USA)). Dec 1987. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004724/JAW.

Clay zones near to but not intersecting an emplacement hole near the work point are a serious containment concern but are not detectable by any NTS logging tool. To develop such a detection capability a variable spaced two loop induction logging tool was designed, built and tested. The two loop induction tool consists of a locally powered 10 kHz resonance oscillated transmitter coil located below a receiver coil that can be spaced from 6 ft. to 150 ft. from the transmitter. All rigging is nonconducting and the transmitter current reference is sent via fiber optic cable to the logging cable head. A lock in amplifier compares the receiver signal to the transmitter reference and separates in-phase and quadrature components. These parameters are stored, along with the values of the tool depth, in an LSI-11 computer as the tool is raised. Logs can be plotted in the field or transferred to other computer systems for subsequent processing. The induction logging tool was fielded in holes U8n and U20aw. The results show the induction tool to be very sensitive to low formation resistivity and that it responded strongly to a known clay lens in U8n. The tool is weakly responsive to high formation resistivities. The induction tool logs were very repeatable, of low noise, and agreed with known hole geologies and BHDH resistivity logs. 7 refs., 13 figs.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 11929

4502 Nuclear

REFER ALSO TO CITATION(S) 12573

12399 **(AD-A—185082/5/XAB) Soviet political responses to Trident and TLAM-N (Tomahawk nuclear land-attack missile). Memorandum report (Final).** Kober, S.H. (Center for Naval Analyses, Alexandria, VA (USA). Naval Warfare Operations Div.). Dec 1986. 18p. (CRM—87-7). NTIS, PC A03/MF A01.

This paper discusses Soviet political responses to Trident and the Tomahawk nuclear land-attack missile. Soviet strategy in arms control is reviewed, and attention is placed on linkage of U.S. strategic offensive forces to the Strategic Defense Initiative. Possible Soviet responses to U.S. proposals are explored.

12400 **(AD-A—185149/2/XAB) Technical papers presented at the Defense Nuclear Agency Global Effects Review. Held at Moffett Field, California on 25-27 February 1986. Volume 1. Technical report, 25 February-12 May 1986.** (Department of Defense Nuclear Information Analysis Center, Santa Barbara, CA (USA)). 15 May 1986. 270p. (DASIAC-TN—86-29-VOL-1). NTIS, PC A12/MF A01.

See also Volume 2, AD-A185 150.

Contents include: urban area analysis and smoke production; a critical examination of methods of estimating the spatial distribution and magnitudes of urban fuel loadings; estimates of total combustible material in NATO and Warsaw pact countries; smoke emission and properties; source-term research program at Sandia National Laboratories; measurements of the radiative properties of smoke emissions from vegetative fuels: relationship of this data to desired information on the properties of urban smoke emissions; wildland fires and nuclear-winters: selected reconstructions of historic large fires; progress in developing the smoke source term for nuclear winter studies: major uncertainties; supermicron wind suspended particles and firestorm plume coagulation; high-reliability fire-start mechanism; collision-formation kinetics and optical properties of sub-micrometer, post-detonation aerosols; radiative properties of dust for input to dust source terms for models of the global effects of a nuclear exchange; micro-analytical techniques for characterizing the optical properties of soil aerosols; overview of DNA's nuclear dust re-analysis program.

12401 **(AD-A—185150/0/XAB) Technical papers presented at the Defense Nuclear Agency Global Effects Review. Held at Moffett Field, California on 25-29 February 1986. Volume 2. Technical report, 25 February-12 May 1986.** (Department of Defense Nuclear Information Analysis Center, Santa Barbara, CA (USA)). 15 May 1986. 343p. (DASIAC-TN—86-29-VOL-2). NTIS, PC A15/MF A01.

See also Volume 3, AD-A185 151.

This document contains technical papers presented at the defense Nuclear Agency Review of Global Effects held at NASA Ames Research Center 25-27 February 1986.

12402 **(AD-A—185151/8/XAB) Technical papers presented at the Defense Nuclear Agency Global Effects Review. Held at Moffett Field, California on 25-27 February 1986. Volume 3. Technical report, 25 February-12 May 1986.** (Department of Defense Nuclear Information Analysis Center, Santa Barbara, CA (USA)). 15 May 1986. 311p. (DASIAC-TN—86-29-VOL-3). NTIS, PC A14/MF A01.

See also Volume 1, AD-A185 149.

This document contains technical papers presented at the Defense Nuclear Agency Review of Global Effects held at NASA Ames Research Center 25-027 February 1986.

12403 **(AD-A—185180/7/XAB) Battlefield fires from tactical nuclear weapons. Technical report, 15 June-15 November 1984.** Woodie, W.L.; Remetch, D.; Small, R.D. (Pacific-Sierra Research Corp., Los Angeles, CA (USA)). 15 Nov 1984. 38p. (PSR—1453). NTIS, PC A03/MF A01.

Fires from tactical weapon exchanges in open terrain can be an important factor in assessing casualties and damage as well as managing troop deployments and operations. In addition to prompt thermal effects and fire starts, spread may also be an important factor on the battlefield. In this report, a model describing the initiation and spread of battlefield fires is presented. The initial ignition distribution is related to the weapon yield, slant range, local atmospheric properties, fuel type, and ignition threshold. The fire-spread analysis is based on an established U.S. Forest Service prediction algorithm. The present tactical ignition and fire-spread (TIFS) model predicts the fire movement over variable terrains and accounts for ambient wind vectors, moisture, changing vegetation, and an arbitrary number of firebreaks. An example calculation illustrating the initial-fire area and subsequent spread in a complex terrain is presented for a 10-kT explosion. The results show the fires extending the effective weapon-damage radius and identify regions to which the fires do not spread.

12404 **(AD-A—185249/0/XAB) Methodology for determining the intent of a limited nuclear attack. Master's thesis.** Bivins, R.L. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). May 1987. 203p. (AFIT/GST/ENS—87J-2). NTIS, PC A10/MF A01.

The purpose of this study was to develop a methodology for determining the intent of a limited nuclear attack. An investigation of possible methodologies for determining intent lead to research in Bayesian analysis. It was thought that the answer to intent could be found by taking prior beliefs of the decision maker and then using the Bayes Theorem to update those beliefs with ground-bases radar information obtained over time. Unfortunately, the use of Bayesian analysis as proposed here did not prove to be robust when the radar information is inaccurate. The reason for the inability of the proposed methodology to perform under the inaccurate radar parameters is that ignores too many of the complicating issues in determining intent.

12405 **(AD-A—185288/8/XAB) Assessment of potential Soviet responses to evolving theater nuclear systems. Master's thesis August 1986-June 1987.** Wightman, R.O. (Army Command and General Staff Coll., Fort Leavenworth, KS (USA)). 5 Jun 1987. 191p. NTIS, PC A09/MF A01.

This study focuses on the Soviet perceptions and decision-making processes that influence Soviet reaction to US initiatives in modernizing or developing theater nuclear systems. Beginning with a discussion about the consequences of previous U.S. misperceptions of Soviet intentions, the study supports the need for ongoing analysis of Soviet actions from the Soviet perspective. The Soviet view of the world is examined in terms of Marxist-Leninist ideology, Soviet fears of encirclement and invasion, and the Soviet perception of world power relationships or correlation of forces . The affect of Soviet military theory on reactions and responses to the subject of U.S. military developments is assessed, specifically in the areas of military doctrine and military science. The influence of military art is discussed with emphasis on strategy and operational art. The Party political controls on Soviet military matters are described, including a breakdown of the military decision making process. Soviet responses to U.S. nuclear weapons initiatives, including the Pershing II, Ground Launched Cruise Missile and Enhanced Radiation Weapons, are discussed in terms of military and political reactions. Soviet use of propaganda is highlighted. The importance of superiority and technology as an integral part of that superiority are examined, as is the Soviet use of technology transfer. This study hypothesizes that any Soviet reaction to U.S. action is based upon unique Soviet perceptions which are strongly influenced by Marxist-Leninist ideology, insecurity, military theory, Party bureaucracy, and world correlation of forces.

12406 **(AD-A—995499/1/XAB) Operation Upshot-Knothole, Nevada Proving Grounds, March-June 1953. Project 7.3. Detection of airborne low-frequency sound from nuclear explosions. Report to the Test Director.** Olmsted, G.B. (Armed Forces Special Weapons Project, Washington, DC (USA)). 15 Feb 1954. 41p. NTIS, PC A03/MF A01.

12407 **(AD-A—995500/6/XAB) Operation Ivy, Pacific Proving Ground, November 1952. Project 7.1. Electromagnetic effects from nuclear explosions. Report to the scientific director.** Oleson, M.H. (Joint Task Force 132, Washington, DC (USA)). 31 Jan 1958. 35p. NTIS, PC A03/MF A01.

12408 **(AD-A—995501/4/XAB) Operation Crossroads. Gross damage report--Test Able.** (Joint Task Force One, Washington, DC (USA)). 28 Jan 1987. 89p. (XRD—213(EX)). NTIS, PC A05/MF A01.

Extracted version of report dated 6 Jul 1946.

12409 **Some developed performance criteria.** Owings, E.; Erickson, O. (Martin Marietta Energy Systems, Inc., Oak Ridge Y-12 Plant, Oak Ridge, TN 37831). *Journal of Nuclear Materials Management;* 16: 81-83(Jul 1987). (CONF-870713—). Contract AC05-84OR21400.

From 28. INMM annual meeting on safeguards: a mature technology; Newport Beach, CA, USA (12 Jul 1987).

This paper describes proposed performance criteria for weapons, test devices, and significant special nuclear material (SNM) parts. The criteria were developed from material control, accountability, and physical security measures. Guidelines discussed in this paper represent a first effort in developing a useful set of Department of Energy material control and accountability (MCandA) performance standards for weapon parts production facilities.

4503 Explosion Detection

12410 **(PB—88-108709/XAB) Seismology, 1986: nuclear test ban verification, earthquake, and earth-resource investigation.** Hammarstroem, M.; Persson, L. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). 1987. 39p. (FOA-C—20662-9.1(2.2)). NTIS, PC E03/MF A01.

See also PB—87-104147.

This progress report summarizes the activities of the Division of Applied Seismology during 1986. In detection seismology, the work at the division was greatly influenced by the agreement by the Ad Hoc Group of Scientific Experts at the Conference on Disarmament in Geneva to redesign the global-verification system to routinely utilize waveform data. This is a most significant agreement towards the establishment of a modern high-quality global seismological network. The development of this new system involves considerable technical as well as scientific challenges.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 12024, 12471

12411 **(DFVLR-IB—553-85-11) On the accuracy of radiation parametrization in mesoscale models.** Dietrich, B.; Kriebel, K.T.; Somieski, F.; Koepke, P.; Meerkoetter, R.; Quenzel, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Oberpfaffenhofen (Germany, F.R.). Inst. fuer Physik der Atmosphaere; Muenchen Univ. (Germany, F.R.). Meteorologisches Inst.). 1985. 8p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751248/JAW.

On the assumption that the results of the solar spectral range can be transferred, at least in order of magnitude, to other model atmospheres and types of soil, some accuracy limits can be derived from comparative calculations: the modified Pielke model gives the radiation flux densities directed downwards on the ground in both spectral ranges with values 15-30 Wm/sup -2/ too high. A sensitivity investigation which still has to be done, must show whether and to what extent the changed ground temperature due to this and therefore the energy balance of the ground falsifies the temperature field in the atmosphere. If necessary, one can remedy this by the use of the Somieski model for global radiation and by correction of the Pielke model for atmospheric radiation. The heating rates are calculated correctly by the modified Pielke model within the limits of accuracy of the 'benchmark' code.

12412 **(KFK—4055) KfK, Institute for Meteorology and Climate Research. Report of results of research and development work 1985.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung). Feb 1986. 10p. (In German). NTIS (US Sales Only), PC A02. Order Number DE88751250/JAW.

The report gives a survey of the following research projects of the Institute since its foundation in 1985: - Experimental support for the development of numerical models of propagation and exchange in the atmosphere in the area up to 1000 km distance; - modelling of atmospheric flow and exchange processes on the mesoscale and - measurement of the deposition of gaseous harmful substances.

12413 **(NP—8750997) Climate problems and their investigation.** (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88750997/JAW.

This publication by the Federal Ministry for Research and Technology informs about the climate research supported by the Federal Government. The state of the art in the following problems is shortly decaribed: natural and man made climate variations, greenhouse effect, carbon dioxide and global warming, ozone, effects of possible climate variations, regional and local climate changes. After a description of climate research activities in foreign countries an excerpt from the basic programme of the Federal Government on climate research follows, including a list of institutions.

12414 **(OH/R—86/231/K) Real-time lightning location system.** Chisholm, W.A. (Ontario Hydro Research Div., Toronto (Canada)). 16 Feb 1987. 17p. (MICROLOG—87-04869). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A network of wideband direction finders has been established throughout Ontario. These receivers pick up radiated fields from distant lightning strokes. The bearing and amplitude data is sent over telephone lines to a central computer. The computer calculates stroke position and amplitude by trianguiation in real time and displays the results on remote graphics terminals. Lightning data for most of Ontario has been available to Ontario Hydro for two summers. This data has been used for tracking the movement of storms.

12415 **(UCRL—15996) Development of a physically-based general circulation model parameterization of clouds and their radiative interactions: Final report.** Schlesinger, M.E. (Oregon State Univ., Corvallis (USA)). Nov 1987. Contract W-7405-ENG-48. 87p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004060/JAW.

In this report we describe our current research under the development of a multi-layer GCM, the design of a physically-based parameterization of clouds, the analysis performed under the Pilot Program for the International Satellite Cloud Climatology Program (ISCCP), and the design of a solar radiation parameterization employing the two-stream and delta-Eddington approximations for multiple scattering. 74 refs., 24 figs., 6 tabs.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10662, 10745, 10746, 10747, 10748, 10751, 10792, 10811, 10862, 10863, 10864, 10906, 11398, 11401, 11607, 11619, 11620, 11736, 11754, 11761, 11768, 11836, 11951, 12021, 12044, 12187, 12507, 12509, 12549, 12559, 12587, 12638, 12641, 12732, 12743, 12752

12416 **(AD-A—185002/3/XAB) Preliminary investigation of the role that DMS (dimethyl sulfide) and cloud cycles play in the formation of the aerosol size distribution. Interim report.** Hoppel, W.A.; Fitzgerald, J.W.; Frick, G.M.; Larson, R.E.; Wattle, B.J. (Naval Research Lab., Washington, DC (USA)). 29 Jul 1987. 37p. (NRL—9032). NTIS, PC A03/MF A01.

A series of experiments designed to study the production of new particulate matter by photolysis of dimethyl sulfide (DMS) and the effect that nonprecipitating clouds have on the aerosol size distributions were carried out in Calspan Corporation's 600 cum environmental chamber during January and February 1986. The results show that DMS, the most-abundant natural source of sulfur, is photooxidized to some product of low volatility that can form new particles by homogeneous nucleation or condense on existing aerosols causing them to grow. To explain these observations, a theoretical study of the nucleation properties of methane sulfonic acid (MSA) was undertaken. The nucleation thresholds, calculated using thermodynamic data for MSA, show that at 70% RH, and MSA concentration of only 0.006 ppb will result in a supersaturated environment in which MSA will condense on preexisting particles larger than 0.02-micron radius. If the MSA concentrations increase to 30 ppb, then spontaneous formation of MSA solution droplets occurs by homogeneous binary nucleation. Simulations of the evolution of the size distribution observed for the DMS irradiation experiments with a dynamic aerosol model that includes the effects of coagulation, growth by condensation, and deposition to the walls of the chamber, yield results that are in excellent agreement with the observed evolution.

12417 **(AD-A—185384/5/XAB) MODTRAN: a moderate resolution model for LOWTRAN. Technical report, 12 May 1986-11 May 1987.** Berk, A.; Bernstein, L.S.; Robertson, D.C. (Spectral Sciences, Inc., Burlington, MA (USA)). 8 Jul 1987. 40p. (SSI-TR—124). NTIS, PC A03/MF A01.

This interim technical report describes a new band-model formulation for the LOWTRAN 6 atmospheric transmittance/radiation computer code. Band-model parameters for H_2O, CO_2, O_3, CO, CH_4, O_2, and N_2 were calculated using the 1986 HITRAN line atlas. They were calculated for 1 /cm bins from 0 - 17,900/cm and at five temperatures from 200 to 300K. This transmittance model and associated subroutines were integrated into LOWTRAN 6. The spectral resolution of this new option is better than 5/cm (FWHM). A preliminary version of the code was delivered to AFGL for testing. Validation against FASCOD2 calculations will be the emphasis for the remainder of this effort.

12418 **(BM—85) Chemical characterization of Canadian fly ashes.** (Barringer Magenta Ltd., Rexdale, Ontario (Canada)). 1985. 3p. (MICROLOG—85-6088). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Numerical data only are presented, representing the chemical composition of twenty-six samples of Canadian fly ashes.

12419 **(BNL—40336) Using SIR [Scientific Information Retrieval System] for data management during a field program.** Tichler, J.L. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 14p. (CONF-8710172—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001555/JAW.

From USIR annual conference; Washington, DC, USA (14 Oct 1987).

As part of the US Department of Energy's program, PRocessing of Emissions by Clouds and Precipitation (PRECP), a team of scientists from four laboratories conducted a study in north central New York State, to characterize the chemical and physical processes occurring in winter storms. Sampling took place from three aircraft, two instrumented motor homes and a network of 26 surface precipitation sampling sites. Data management personnel were part of the field program, using a portable IBM PC-AT computer to enter information as it became available during the field study. Having the same database software on the field computer and on the cluster of VAX 11/785 computers in use aided database development and the transfer of data between machines. 2 refs., 3 figs., 5 tabs.

12420 **(CANMET—850215) A study to assess the effects of diesel emissions on air quality in the PCS Mining Lanigan Division underground potash mine. Final report.** Johnson, J.H.; Carlson, D.H. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 15 Feb 1985. 81p. (MICROLOG—85-6084). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A study of the air quality in a diesel truck haulage operation in the PCS Mining Lanigan Division was conducted. The objective was to develop baseline diesel pollutant measurement data for the 'drive location development' operation considered to be the worst diesel situation in the mine. CO, NO, NO/sub 2/, and particulate matter data were measured over a 5-day period along with CO/sub 2/ at four locations. Data were analyzed to determine how the above pollutants, as well as SO/sub 2/ and SO/sub 4/, compare to the applicable standards and the air quality index. The study was conducted to reveal the order of pollutants from most to least critical, to evaluate the need for controls, and to provide a basis for sound engineering judgements about the types of controls that would be most effective. The results are presented as pollutant characteristic curves. Special treatment of the data was required because of significant concentrations of the pollutants and CO/sub 2/ due to direct-firing of natural gas to warm the air taken into the mine. NO/sub 2/ was considered to be the diesel pollutant of major concern and the one that needs to be controlled by avoiding recirculation or long residence time in the mine ventilation system, which allows NO to react with oxygen and produce NO/sub 2/. Significant changes in background concentrations will occur if the direct-firing of natural gas in the mine intake air is changed or eliminated as anticipated for the warm season. The need for specific air quality measurements and monitoring of fuel sulfur levels is also discussed. 21 figs., 11 tabs.

12421 **(CU—AOSERP/133) The use of aircraft measurements to determine transport, dispersion and transformation rates of pollutants emitted from oil sands extraction plants in Alberta.** Cheng, L.; Davis, A.; Peake, E.; Rogers, D. (Calgary Univ., Alberta (Canada)). 1987. 129p. (MICROLOG—87-04817). Alberta Environment, Research Management Division, Publications Office, 14th. Floor, Standard Life Centre, 10405 Jasper Ave., Edmonton, Alta., Canada T5J 3N4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A field program study was conducted to determine the transport, dispersion, and transformation of sulphur and nitrogen oxides emitted from oil sands extraction plants. Measurements using the research aircraft were made under both cold winter conditions and warm summer conditions. Sulphur dioxide emissions were detected as far as 90 km downwind from the source stack. The rate of transformation of SO/sub 2/ to SO/sub 4/ was determined to be higher in the summer, and attributed to greater solar irradiance. Excess aerosol volume productions suggest that heterogeneous conversion may be appreciable under certain meteorological conditions and close to the emission source. The conversion rate of NO to NO/sub 2/ varied considerably hour to hour correlated with turbulent mixing. During cold winter conditions ice crystals nucleated in the gaseous plume, grew to precipitation size, and fell out of the plume to the earth's surface. This snow-out phenomenon was present only in the emission plume within about 10 km of the stack. 29 figs., 23 tabs.

12422 **(DOE/ER/60348—6) SPREX [Spring Removal Experiment]: Hydrographic data report: Volume 3, Chlorophyll and nutrients, April 1985.** Chandler, W.S.; Bush, K.A.; Kim, C.; Berger, T.J.; Atkinson, L.P. (Old Dominion Univ., Norfolk, VA (USA). Research Foundation). Dec 1987. Contract FG05-85ER60348. 243p. (TR—87-11). NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88004103/JAW.

SPREX (Spring Removal Experiment) took place to determine the processes affecting the transport and fate of freshwater input to the continental shelf off Georgia and South Carolina during the time of expected high runoff. It was hypothesized that this water is transported offshore in spring by a semi-permanent cyclonic eddy located at about 32°N, 79°W. The SPREX field program included a large array of moored current meters and other instruments, and three research vessels (R/V Cape Floria, R/V Cape Hatteras, and R/V Blue Fin) that conducted hydrographic mapping and biological and chemical sampling. The R/V Blue Fin conducted a series of seven one-day cruises covering a small region of the inner continental shelf near the Savannah River, which is the major freshwater source to the area. Ship surveys were designed to provide near synoptic coverage of a few specific events during SPREX. The purpose of the surveys was to determine the time variations in fresh water content and tracer concentrations over the shelf, the characteristics of shelf water/Gulf Stream water interaction, and biological responses to the events. 4 refs., 3 figs., 1 tab.

12423 **(DOE/ER/60348—7) Continental shelf processes affecting the oceanography of the South Atlantic Bight: Progress report, June 1, 1987 to May 31, 1988.** Atkinson, L.P. (Old Dominion Univ., Norfolk, VA (USA). Research Foundation). Jan 1988. Contract FG05-85ER60348. 37p. (TR—87-12). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004102/JAW.

This study of continental shelf processes affecting the oceanography of the South Atlantic Bight (SAB) is part of the interdisciplinary DOE-sponsored South Atlantic Bight Program. Our part of the program involves hydrographic and nutrient characteristics of the region. Current research efforts in the SAB Program are being focused on the inner shelf region where effects of bottom friction, local wind forcing, river and estuarine discharge, and tides, which are all small scale processes, are important. Our major accomplishment during the past year was the completion of the FLEX (Fall Experiment) field study. Since most of our data collection is computerized, preliminary hydrographic data analysis was done on board ship during the cruise and preliminary results are available. These results will be presented in this report. We are just beginning our standard data processing and data analysis procedures. We continued the processing and analysis of SPREX data collected during April 1985. Work has also continued on the older GABEX I and II data sets. 8 refs., 19 figs., 2 tabs.

12424 **(DOE/ER/60549—1) Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1987-February 29, 1988.** Burns, F.J. (New York Univ., NY (USA). Medical Center). 1988. Contract FG02-87ER60549. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003788/JAW.

The objective of this project is to evaluate radon cancer risks in polluted environments. Rats are exposed by tracheal implant to an alpha source in combination with inhalation exposure to NO_2 or cigarette smoke. Direct measurement of DNA strand breaks in the respiratory epithelium is made by alkaline elution. The carcinogenicity to the respiratory epithelium of these treatments will be established in long term tests. This report describes one years accomplishments. 2 figs., 1 tab.

12425 **(DOE/OR/21389—T8) Particulate emissions from residential wood combustion: Final report: Norteast regional Biomass Program.** (Weston (Roy F.), Inc., West Chester, PA (USA)). 1987. Contract FG05-83OR21389. 152p. NTIS, PC A08. Order Number DE88003552/JAW.

The objective of this study was to provide a resource document for the Northeastern states when pursuing the analysis of localized problems resulting from residential wood combustion. Specific tasks performed include assigning emission rates for total suspended particulates (TSP) and benzo(a)pyrene (BaP) from wood burning stoves, estimating the impact on ambient air quality from residential wood combustion and elucidating the policy options available to Northeastern states in their effort to limit any detrimental effects resulting from residential wood combustion. Ancillary tasks included providing a comprehensive review on the relevant health effects, indoor air pollution and toxic air pollutant studies. 77 refs., 11 figs., 25 tabs.

12426 **(EPRI-EA—5473) Evaluation of regional-scale air quality models: Chairmen reports from four workshops: Final report.** Barchet, W.R. (ed.). (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 161p. NTIS, PC A08/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. Order Number DE88001397/JAW.

Regional acid deposition models are to be scientifically defensible tools for analyzing the consequences of proposed emissions control policies for acid deposition abatement. Complete chairman's reports for the four workshops are presented in this document. This first produced a technical plan for the Operational Evaluation Network (OEN). Criteria for site selection are given. Measurement requirements and sampling and analytical procedures are specified. The second workshop dealt with the need for model evaluation protocols. Additional measurement needs, crucial to model evaluation, were defined. Vertical profiles of ambient concentrations and meteorological conditions were recommended to provide the third dimension for model evaluation. Specific studies that focus on the evaluation of individual modules within the comprehensive models were also defined. In the third workshop working definitions of terms associated with the model evaluation program were codified. Comparison of the spatial and temporal resolution of modeled and observed quantities led to recommendations on how the field programs are to obtain the data. The fourth workshop focused on quality assurance and data archival for model evaluation field studies. The workshop provided a set of guidelines and objectives to be used to design and implement a quality assurance program for these tasks. Guidelines for data management and archival were formulated. These included provisions for data distribution, documentation, and archival. Chapters are processed separately for the data base.

12427 (EPRI-EA—5473, pp 1.2.1-1.9.2) **Technical plan for an operational evaluation network workshop, November 19-21, 1985, Seattle, Washington.** Pennell, W.T.; Hales, J.M.; Spicer, C.W.; Barad, M.L.; Barchet, W.R. (ed.). (Battelle Pacific Northwest Labs., Richland, WA; Battelle Columbus Labs., OH; Barad Consultants, Inc., Belmont, MA). Oct 1987. NTIS, PC A08/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE88001397/JAW.

In Evaluation of regional-scale air quality models: Chairmen reports from four workshops: Final report.

The purpose was to advise on the design of a precipitation chemistry and aerometric monitoring network that would provide the information needed to evaluate the performance of regional-scale acid deposition models. The original name of the network was changed to reflect the application on which the network design was based. 5 refs., 6 figs., 8 tabs.

12428 (EPRI-EA—5473, pp 2.1.1-2.7.2) **Model evaluation protocols workshop, February 11-13, 1986, Raleigh, North Carolina.** Pennell, W.T. (Battelle Pacific Northwest Labs., Richland, WA). Oct 1987. NTIS, PC A08/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE88001397/JAW.

In Evaluation of regional-scale air quality models: Chairmen reports from four workshops: Final report.

This report discusses procedures and protocols for evaluating regional-scale acid deposition models. The workshop considered procedures to be used in evaluating the performance of acid deposition models and methodologies for applying these procedures, data requirements of these procedures and methodologies, the probable impact of time and budget constraints on the evaluation process, and possible conflicts between client needs and the probable output of the evaluation program. Each of these topics was considered, and a series of recommendations were made. These

recommendations covered the manner in which the evaluation should be conducted, the specific tasks that should be undertaken to effect the evaluation, the data requirements of the recommended evaluation program, and the types of questions that can and cannot be answered by such a program. 5 tabs.

12429 (EPRI-EA—5473, pp 3.1.1-3.9.2) **Field study design workshop, March 11-13, 1986, Seattle, Washington.** Barchet, W.R. (Battelle Pacific Northwest Labs., Richland, WA). Oct 1987. NTIS, PC A08/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE88001397/JAW.

In Evaluation of regional-scale air quality models: Chairmen reports from four workshops: Final report.

The objectives of this workshop were to describe the field measurement tasks and identify the measured variables along with their space/time resolution and accuracy. Working definitions were developed for the terms operational and diagnostic evaluation. Operational evaluation considers how well the model predicts values, and is used in policy decisions or effects assessments. Diagnostic evaluation establishes the scientific credibility of these results. Workshop recommendations on operational evaluation highlighted the adequacy of the proposed United States surface network and the need for additional sites in southeastern Canada. Recommendations for diagnostic evaluation focused on measurement needs for gas phase chemistry, dry deposition, wet deposition, and transport module evaluation. Recommendations on supporting observations noted the inadequacy of current emissions inventories, the importance of aircraft sampling to establishing three-dimensional observational fields, and the need for estimates of subgrid-scale variability of surface observations. 2 refs., 4 figs., 7 tabs.

12430 (EPRI-EA—5473, pp 4.1.1-4.6.3) **Quality assurance workshop, June 11-13, 1986, Toronto, Ontario.** Olsen, A.R. (Battelle Pacific Northwest Labs., Richland, WA). Oct 1987. NTIS, PC A08/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE88001397/JAW.

In Evaluation of regional-scale air quality models: Chairmen reports from four workshops: Final report.

This workshop provides guidance in evaluating the performance of regional-scale acid deposition models currently being developed for these organizations. The workshop focused on identifying various protocols for evaluating models against field observations. The Quality Assurance Workshop focused on developing an approach to an integrated quality assurance program and on addressing the requirements for data archival and coordination activities necessary for model evaluation. The purposes of this workshop were to define an approach to an integrated quality assurance program; to identify and define elements of a quality assurance program that will ensure that the data quality objectives are met and to recommend experiments to determine if the objectives are met; to define a data management and archival structure that will meet the requirements of the model evaluation program and to identify an existing data system that can meet these requirements; and to consider coordination activities for all of the tasks within the model evaluation program, as well as other related monitoring and research tasks supported by National Acid Precipitation Assessment Program (NAPAP), EPA, EPRI, AES, and OME.

12431 (EUR—10513) **Development of a set of computer programs to calculate the evolution of emission patterns for different fuel consumption and exhaust gas emission scenarios for selected countries within the EEC.** Jost, P.; Brosthaus, J.; Sonnborn, K.S. (Commission of the European Communities, Luxembourg). 1986. 60p. Commission of the European Communities, Luxembourg. Order Number DE88751708/JAW.

The set of programs is divided into a package for gasoline-engined vehicles (cars), a package for diesel-engined vehicles (mainly vans and lorries) and a program to compare the results obtained for these two types of vehicular traffic. The report contains a general block diagram of the programs and figures are included which display the interaction between the programs and also give examples of the structure of the different data banks. In individual sub-sections the various possibilities of presentation within one program package are explained as well as the interaction of the programs with one another. The results presented for the evolution of the exhaust gas emissions of car traffic in some selected EEC countries, the possible trend of exhaust gas emissions of commercial traffic in the Federal Republic of Germany and the various possibilities of presentation of the emissions of car and commercial traffic give insight into the manifold application possibilities of the program packages presented. This computer program provides an instrument with which to evaluate the effects of, for instance, legislative and/or economic measures on the exhaust gas emission and fuel consumption of the total vehicle fleet. However in order to employ their capabilities to the full, it is essential to provide adequate analytical and forecast data as input to the programs.

12432 (INPE—4232-PRE/1107) **Carbon monoxide (CO) concentration in the air as a purity parameter.** Kirchhoff, V.W.J.H.; Marinho, E.V.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1987. 31p. (In Portugese). (CONF-870798—). NTIS, PC A03/MF A01.

From 39. annual meeting of the Brazilian Society for the Advancement of Science; Brasilia, DF, Brazil (12 Jul 1987).

Carbon monoxide (CO) is a natural component of the atmosphere and is part of important chemical cycles, especially as ozone references. Processes of combustion can add CO to the atmosphere, and in this case can represent a precursor of ozone. To determine quantitatively how far large industrial centers affect the atmosphere of natural ecosystems, the Ozone Laboratory of INPE recently installed an ultra-sensitive CO sensor capable of detecting several parts per billion CO. Initial measurements were achieved in Sao Jose dos Campos, Cachoeira Paulista, Via Dutra, Belem (PA), and Horto Florestal de Campos do Jordao. The major concentrations were observed in Sao Jose dos Campos where the concentrations were greater than from Horto Florestal by a factor of 3 to 6 times. The concentration measurements on the surface were greatest in the morning, decreasing through dilution in the mixing layer about 2 hours before the middle of the day.

12433 (LBL—23087) **Application of a multisorbent sampling technique for investigations of volatile organic compounds in buildings.** Hodgson, A.T.; Girman, J.R. (Lawrence Berkeley Lab., CA (USA)). Aug 1987. Contract AC03-76SF00098. 26p. (CONF-8704219—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001391/JAW.

From ASTM symposium on design and protocol for monitoring indoor air quality; Cincinnati, OH, USA (26 Apr 1987).

An analytical method for volatile organic compounds (VOC) that employs a multisorbent sampler containing, in series, Tenax-TA, Ambersorb XE-340, and activated charcoal is described. The method was evaluated and then used to measure concentrations of VOC at a school and an office building. The sampler quantitatively collects compounds spanning a broad range of boiling points, including highly volatile solvents. The overall precision of the method is better than 10% and often better than 5%. The composition and concentrations of VOC in the two, approximately five-month old, non-residential buildings were similar and also similar to the composition and concentrations in typical residential indoor air. Concentrations of VOC were measured at two ventilation rates in both non-residential buildings, and the data were applied to a single-equation mass-balance model. Apparent specific source strengths for VOC approximately doubled with a six-fold increase in ventilation rate. 17 refs., 4 figs., 4 tabs.

12434 (N—88-10432) **Study of carbon monoxide distribution determinations for a global transport model. Semiannual progress report, 1 May-31 October 1987.** Peters, L.K.; Manning, J.O. (Kentucky Univ., Lexington (USA)). Nov 1987. 10p. (NASA-CR—181423; NAS—1.26:181423). NTIS, PC A02/MF A01.

A system of programs which model the chemistry and transport of carbon monoxide and methane in the Earth's atmosphere on a global scale was installed onto the NASA-Langley central scientific computer network. This system, the GLOBAL system, consists of a user-friendly set of procedural files which allow for simplified pre-processing, execution, and post-processing for all program elements. The package includes procedures for obtaining the NMC meteorological data, calculating the vertical winds to satisfy

mass conservation, determining the boundary layer, and executing the transport/chemical model for carbon monoxide. In addition, plotting, saving to tape, and reading from tape routines were developed. Final modifications to the subprograms for processing the input data for the transport/chemistry model have improved these data to more accurately reflect true atmospheric conditions. The transfer of the transport/chemistry model from the NCAR CRAY system to the NASA-Langley VPS-32 system was completed. The problems encountered during this process and their resolutions are discussed.

12435 **(NP—8751231) Wuerzburg as an area of high air pollution. Register of emissions, register of immissions.** Stepper; Raab; Boellmann; Roessert. (Bayerisches Landesamt fuer Umweltschutz, Muenchen (Germany, F.R.)). Sep 1986. 198p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88751231/JAW.

The Wuerzburg area is one of eight areas of high pollution in Bavaria. The necessity to categorize the area of the town as an area of high pollution arose from the fact of vegetation damage having occurred here as early as at the beginning of the seventies which was believed to be due to airborne pollutants. The emission register shows the emissions from traffic, industry, household furnaces, and trade and thereby points out centres of emission. The register of nuisances presents the results of air pollution as constantly monitored to determine the development in relation to time and as sampled and measured to record the spatial structure of pollution in the pollution area. As the measuring results show, the limiting values of pollution given by the Clean Air Technical Guide are not exceeded. A clear difference is noted between pollution in the centre of the town and its outskirts.

12436 **(NP—8751242) Reports on the quality of air in North-Rhine Westphalia. Special measurements at Ahlen, October 1-30, 1986.** (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)). 1987. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751242/JAW.

The harmful components sulfur dioxide, nitrous oxide, nitric oxide and suspended matter and the meteorological parameters of wind direction and wind speed are continuously recorded by means of mobile measurement stations at given sites for a measuring period of at least four weeks. The results are given for the components SO/sub 2/, NO, NO/sub 2/ and suspended matter as mean values over half-hour periods and in micrograms per cubic metre.

12437 **(NP—8751244) Reports on the quality of air in North-Rhine Westphalia. Special measurements at Kerpen, October 1-31, 1986.** (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)). 1987. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751244/JAW.

The harmful components sulfur dioxide, nitrous oxide, nitric oxide, carbon monoxide and suspended matter and the meteorological parameters of wind direction and wind speed are continuously recorded by means of mobile measuring stations at the given sites for a period of at least four weeks. The results from the period of measurement are given for the components SO/sub 2/, NO, NO/sub 2/ and suspended matter as the mean over half hour periods in micrograms per cubic metre and for CO in milligrams per cubic metre.

12438 **(NP—8751246) Reports on the quality of air in North-Rhine Westphalia. Special measurements at Minden, October 1-30, 1986.** (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)). 1987. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751246/JAW.

The harmful components sulfur dioxide, nitrous oxide, nitric oxide and suspended matter and the meteorological parameters of wind direction and wind speed are continuously recorded by means of mobile measurement stations at the given sites for a period of at least four weeks. The results from the period of measurement are given for the components SO/sub 2/, NO, NO/sub 2/ and suspended matter as mean values over half hour periods in micrograms per cubic metre.

12439 **(OH/R—86/320/K) Measurement of droplet size and velocity using a phase doppler anemometer.** Elphick, I.G. (Ontario Hydro Research Div., Toronto (Canada)). 12 Feb 1987. 37p. (MICROLOG—87-04875). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The application of Laser Doppler Anemometry (LDA) to droplet size and velocity measurements was investigated. After reviewing various methods based on light scattering, the Phase Doppler Anemometer (PDA) was chosen for verification. The droplet size standard was a monodisperse droplet generator. Its capability of generating a stream of uniform size droplets was verified with photographs. The theory of operation for the PDA and a design criteria for the optical detector are given. It was shown that velocity measurements could be based on the single-phase LDA theory. The droplet sizing capabilities of the PDA were evaluated by measuring the monodisperse droplets. The results of the verification show that the PDA is a useful tool for the non-intrusive measurement of droplet size. 9 tabs., 11 figs.

12440 **(PB—88-100755/XAB) Measurements of solar radiation at Mauna Loa Observatory, 1978-1985, with emphasis on the effects of the eruption of El Chichon. Data report.** Dutton, E.G.; DeLuisi, J.J.; Austring, A.P. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Jul 1987. 41p. (NOAA-DR-ERL-ARL—13). NTIS, PC A03/MF A01.

Results from three different projects that involved either absolute or relative measurement of solar radiation at the NOAA Mauna Loa Observatory are reported. Included are measurements, in summary form, of broadband solar irradiance, spectral aerosol optical depth, and spectral diffuse-sky irradiance. Each data set includes the influence of the stratospheric debris from the eruption of El Chichon. Procedures that were used to acquire and finalize the observational records are documented.

12441 **(PB—88-101654/XAB) Effects of acidity of simulated rain and its joint action with ambient ozone on measures of biomass and yield in soybean.** Troiano, J.; Colavito, L.; Heller, L.; McCune, D.C.; Jacobson, J.S. (Boyce Thompson Inst. for Plant Research, Ithaca, NY (USA)). 1983. 9p. NTIS, PC A02/MF A01.

Pub. in Environmental and Experimental Botany, Vol. 23, No. 2, 113-119(1983).

An experiment was performed to determine whether the presence of ozone modified the effects of acidity of simulated rain on growth and yield of soybean. Beeson, a type II cultivar, was grown in field chambers and exposed to simulated rain at 3 levels of acidity. Each level was applied to plants grown either in unfiltered ambient air or in charcoal filtered ambient air. An interaction between acidity of simulated rain and filtration of ambient air on growth and yield was present. The difference in total dry mass between plants grown in filtered and unfiltered chambers increased acidity, of simulated rain treatments. In filtered air, vegetative mass was only slightly decreased with increased acidity, whereas reproductive mass was increased with increased acidity. In unfiltered air-vegetative mass decreased with increased acidity but reproductive mass was only slightly decreased at pH 2.8. Components of yield also were differentially affected by acidity, which indicates the need for a better understanding of the sensitivities of different developmental processes of the plant to each kind of pollutant. The apparent interaction between ozone and acidic-rain indicates that further investigations on the combination must be conducted before acidic rain effects on plant growth can be accurately assessed in ambient atmospheres.

12442 **(PB—88-101688/XAB) Book review of Acid Rain: a Water Resources Issue for the 80's'.** Church, M.R. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). 1987. 4p. (EPA—600/M-87/027). NTIS, PC A02/MF A01.

Pub. in Transactions of the American Geophysical Union, Vol. 68, No. 15, 209, 212(Apr 1987).

This volume is a collection of papers dealing with a variety of topical areas associated with the study of the effects of acidic deposition on watersheds and water resources. Because the volume was published in 1983, most of the research that contributed to these papers was conducted in the early 1980s and thus is somewhat dated. For this reason, the volume is not useful as an index to the current state of the art in the topical fields presented. Its principal utility lies in presenting some interesting data from early phases of continuing projects (e.g. the Shenandoah Watershed Acidification Study by Shaffer and Galloway) and in providing a historical snapshot of some avenues of research early in the study of acid rain in the United States.

12443 **(PB—88-103734/XAB) Prevention reference manual: chemical specific. Volume 12. Control of accidental releases of sulfur dioxide. Final report, October 1986-June 1987.** Davis, D.S.; DeWolf, G.B.; Quass, J.D.; Stohs, M. (Radian Corp., Austin, TX (USA)). Sep 1987. 155p. (DCN—87-203-023-94-16). NTIS, PC A08/MF A01.

See also Volume 9, PB—87-228664.

This report discusses the control of accidental releases of sulfur dioxide (SO_2) to the atmosphere. SO_2 has an IDLH (immediately dangerous to life and health) concentration of 100 ppm, making it an acute toxic hazard. Reducing the risk associated with an accidental release of SO_2 involves identifying some of the potential causes of accidental releases that apply to the processes that use SO_2. The manual identifies examples of potential causes and measures that may be taken to reduce the accidental release risk. Such measures include recommendations on: plant design practices; prevention, protection, and mitigation technologies; and operation and maintenance practices. Conceptual cost estimates of possible prevention, protection, and mitigation measures are provided.

12444 **(PB—88-103866/XAB) Semi-empirical mass-balance approach for estimating primary emissions of reactive species from an urban-industrial complex.** Ching, J.S.; Gillani, N.V.; White, W.H. (Washington Univ., St. Louis, MO (USA). Dept. of Mechanical Engineering). Sep 1987. 24p. NTIS, PC A03/MF A01.

A semi-empirical mass-balance method for indirect estimation of urban NOx and volatile organic compounds emissions are described. It requires measurement of ambient concentrations of these precursors at urban inflow and outflow boundaries and of the local wind field. In the mass balance, the effect of chemical transformations and removal of the mass-balance species (primary as well as secondary) is estimated by means of a crosswind-resolved reactive plume model. As part of an on-going EPA-sponsored project, the method will be applied to existing field data of four eastern U.S. urban areas. The existing data bases were not developed for the present purpose, and are much less than ideal. The outline of a design field study specifically aimed at the current objectives is also described.

12445 **(PB—88-104138/XAB) Methods and results of characterization of organic emissions from an indoor material.** Sanchez, D.C.; Mason, M.; Norris, C. (Acurex Corp., Research Triangle Park, NC (USA)). 1987. 18p. NTIS, PC A03/MF A01.

Pub. in Atmospheric Environment, Vol. 21, No. 2, 337-345(Feb 1987).

This paper presents the method and example results for determing organic air emissions from a common indoor material (a water-based adhesive). A well-instrumented and characterized 0.166 cu m stainless steel test chamber was used to ventilate sample materials at controlled air change rates, temperatures, and relative humidities. The test chamber outlet air stream was sampled using Tenax (1.6 g) filled glass cartridges. The Tenax sample cartridges were then thermally desorbed for further concentration onto a Nutech model 8528 purge-and-trap system and desorption to a packed-column gas chromatograph for analysis. Organic emissions were quantified on species-specific and total-organics bases. Test chamber concentrations of total organics for the adhesive were observed to diminish with time. Calculated emission rates for the adhesive were determined to be 95 micrograms/g/hr after ventilation at 1.77 air changes per hour (ACHs) for 10 hr, and 259 micrograms/g/hr after 24-hr ventilation at 3.6 ACHs.

12446 **(PB—88-104146/XAB) Characterization of emissions from combustion sources: controlled studies.** Tucker, W.G. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). 1987. 6p. (EPA—600/J-87/072). NTIS, PC A02/MF A01.

Pub. in Atmospheric Environment, Vol. 21, No. 2, 281-284(Feb 1987).

This paper summarizes Session I papers (given at the EPA Workshop on Characterization of Contaminant Emissions from Indoor Sources, Chapel Hill, NC, May 1985) that illustrate the progress made to date on characterizing indoor-combustion emissions from unvented space heaters, gas appliances, and sidestream cigarette smoke. The state of knowledge of such emissions and their controllability is summarized by four general statements: (1) Unvented gas-fired appliances are important sources of indoor CO and NOx, but not of organic emissions; (2) Important combustion sources of indoor organics, include smoking and possibly kerosene heaters; (3) The extent of the problems of leakage from vented appliances is simply not known; (4) Indoor combustion sources do not appear to present major problems with controllability, if source removal is an acceptable alternative. From an engineering standpoint, the most-challenging issue is burner design changes for unvented appliances.

12447 **(PB—88-104153/XAB) Screening methods for the identification of organic emissions from indoor-air-pollution sources.** Merrill, R.G.; Steiber, R.S.; Martz, R.F.; Nelms, L.H. (Acurex Corp., Research Triangle Park, NC (USA)). 1987. 8p. NTIS, PC A02/MF A01.

Pub. in Atmospheric Environment, Vol. 21, No. 2, 331-336(Feb 1987).

The paper discusses screening methods for identifying organic emissions from indoor-air-pollution sources. The development of on-line gas chromatographic (GC) screening procedures is necessary to permit subsequent evaluation of materials in test-chamber studies. The screening uses techniques such as static vapor-phase sampling by headspace methods, and a dynamic method similar to the purge-and-trap procedures used for determining volatile organic compounds in water samples. These are methods of sampling that simulate chamber conditions on a small scale, while allowing emissions to be collected and analyzed. The evaluation is done to select GC columns and develop operating conditions that will permit the rapid and reliable separation of chemical compounds generated during testing. The GC procedure is used in the qualitative identification of chemical compounds by GC/mass spectrometry (MS). After identification of the compounds or their chemical classes, representative members are selected as calibration standards for the actual emission testing program.

12448 **(PB—88-104179/XAB) Lung cancer and indoor air pollution in Xuan Wei, China.** Mumford, J.L.; He, X.Z.; Chapman, R.S.; Cao, S.R.; Harris, D.B. (Environmental Protection Agency, Research Triangle Park, NC (USA)). 1987. 7p. (EPA—600/J-87/074). NTIS, PC A02/MF A01.

Pub. in Science, Vol. 235, 217-220(Jan 1987).

Xuan Wei County, China has an unusually high lung-cancer mortality rate that cannot be attributed to tobacco use or occupational exposure. Most Xuan Wei residents, especially women, are exposed domestically to smoke from unvented, open pit coal/wood fires used for cooking and heating. Samples collected during combustion of smoky coal, smokeless coal, and wood were examined for physical and chemical characteristics and for mutagenicity in the Ames Salmonella mutagenesis assay. Samples collected in two communes in which lung cancer rates are high and smoky coal is the predominant fuel contained high concentrations of submicron particles of high organic content. Indoor levels of polycyclic aromatic hydrocarbons in these communes were comparable to occupational exposure levels. Samples from homes in a wood-burning commune that has a low lung cancer rate, on the other hand, mostly consisted of larger particles of lower organic content. Extracts of these samples, containing mostly polar compounds displayed little mutagenicity.

12449 **(PB—88-106422/XAB) AEERL (Air and Energy Engineering Research Laboratory) research plan on the global climate emissions assessment and stabilization program.** Mobley, J.D.; Jones, J.W. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). Sep 1987. 50p. (EPA—600/D-87/303). NTIS, PC A03/MF A01.

The paper discusses the Environmental Protection Agency's (EPA) Air and Energy Engineering Research Laboratory (AEERL) research plan for work in the global climate area. The plan, written for discussion with senior scientists and program managers at EPA's Global Climate Change Research Workshop in September 1987, consists of five major parts: emission inventory, emission factor development, emission forecast model, control technology assessment, and control technology development. Plans for work in each of these areas and the relationship of AEERL's work to that being done by other researchers are discussed in the research plan. Projected budgets and schedules are presented.

12450 **(PB—88-107032/XAB) Prevention reference manual: chemical specific. Volume 10. Control of accidental releases of hydrogen cyanide. Final report, November 1986-June 1987.** Davis, D.S.; DeWolf, G.B.; Quass, J.D. (Radian Corp., Austin, TX (USA)). Sep 1987. 134p. (DCN—87-203-024-98-35). NTIS, PC A07/MF A01.

See also PB—87-227047.

The report discusses the control of accidental releases of hydrogen cyanide (HCN) to the atmosphere. HCN has an IDLH (immediately dangerous to life and health) concentration of 50 ppm, making it an acute toxic hazard. Reducing the risk associated with an accidental release of HCN involves identifying some of the potential causes of accidental releases that apply to the process facilities that use HCN. The manual identifies examples of potential causes and measures that may be taken to reduce the accidental release risk. Such measures include recommendations on: plant design practices; prevention, protection, and mitigation technologies; and operation and maintenance practices. Conceptual cost estimates of example prevention, protection, and mitigation measures are provided. The accidental release of a toxic chemical at Bhopal, India, in 1984 was a milestone in creating an increased public awareness of toxic release problems. As a result of other, perhaps less dramatic, incidents in the past, portions of the chemical industry were aware of this problem long before Bhopal.

12451 **(PB—88-107081/XAB) Design and characterization of an isokinetic sampling train for particle-size measurements using emission gas recycle.** Williamson, A.D.; Martin, R.S.; Harris, D.B.; Ward, T.E. (Southern Research Inst., Birmingham, AL (USA)). 1987. 7p. NTIS, PC A02/MF A01.

Pub. in JAPCA, Vol. 37, No. 3, 249-253(Mar 1987).

This paper describes a particulate sampling train that satisfies the conflicting requirements of isokinetic sample extraction and constant flow rate through an inertial sizing device. A variable fraction of the filtered emission gas is added to the sample upstream of the inertial sizing device to maintain a preselected flow rate through the device, while the gas flow rate into the sampling nozzle is adjusted to remain isokinetic with the local duct velocity. The prototype emission gas recycle (EGR) train was constructed by relatively simple modifications of a commercially available Method 5 sampling system, and much of the sampling technique is identical with Method 5 protocol. The train was tested by comparing parallel runs in the EPA/SoRI wind tunnel using redispersed fly ash. In one series of runs performed without inertial sizing devices, the EGR train, and a colocated non-EGR train sampled three-point traverses.

12452 **(PB—88-107099/XAB) Effects of simulated acidic rain on one species each of Pseudoparmelia, Usunea, and umbilicaria.** Sigal, L.L.; Johnston, J.W. (Oak Ridge National Lab., TN (USA). Environmental Sciences Div.). 1986. 11p. NTIS, PC A03/MF A01.

Pub. in Water, Air and Soil Pollution, Vol. 27, 315-322(1986).

The lichens Pseudoparmelia caperata (L.) Hale, Usnea of subfusca Stirt., and Umbilicaria mammulata (Ach.) Tuck. were exposed to simulated acidic rain with pH levels of 2.3, 3.0, 3.3, 4.3, or 5.6 and other ions in concentrations normally found in rain in the eastern United States. The pH levels of the most-acidic treatments (3.3, 3.0, 2.3) were similar to those found in fog, cloud water, and occasional rainfall events. The pH 4.3 and 5.6 treatments compared to average ambient conditions in the eastern and western United States, respectively, and caused no significant effects on photosynthesis. However, after the first week of treatment, significant effects of rain pH at the most-acidic treatments on gross photosynthesis were detected in P. caperata and U. mammulata, but not in U. of subfusca. Visible effects of injury were also observed and included bleaching, necrotic spots, and necrotic margins, which resembled damage seen in field populations of U. mammulata, the most-sensitive species.

12453 **(PB—88-107735/XAB) Evaluation of emission sources at a waferboard manufacturing plant. Final report.** Stelling, J.H.E. (Radian Corp., Research Triangle Park, NC (USA)). Sep 1987. 77p. NTIS, PC A05/MF A01.

A state pollution control agency requested assistance from EPA's Control Technology Center (CTC) in determining possible emission sources within the plant and assessing potential controls for those emissions. The report summarizes the results of a site visit and the review of the plant operations and test reports. Data gathering involved collection of test reports, permit applications and other information on waferboard manufacturing operations. States where waferboard is manufactured were contacted to establish controls used for various operations. A site inspection was made to examine operations first-hand and to verify controls in-place. In addition, one state office was visited to discuss the extent of complaints, stack tests conducted, and results of emission dispersion modeling. It appears that substitution of another wood species for aspen which is currently predominantly used would reduce emissions. Another potential option for reduction of emissions is a variation of the dryer operating conditions. Use of a water or caustic scrubber is another potential control mechanism.

12454 **(PB—88-107743/XAB) National Dioxin Study Tier 4 - combustion sources: project summary report. Final report.** Lillis, E.J.; Southerland, J.H.; Lamason, W.H.; Kuykendal, W.B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1987. 39p. (EPA—450/4-84/014G). NTIS, PC A03/MF A01.

See also PB—86-191061.

This report presents the Agency's finding on the assessment of dioxin emissions from combustion sources under Tier 4 of the National Dioxin Strategy. The primary objectives of Tier 4 are outlined in the report. The report describes the information of the Agency collected at the request of Congress to improve the current understanding of combustion sources that emit dioxin to the ambient air. The tasks used to collect the information are outlined, including stack testing, ash sampling, and data analysis. References to other documents that describe methods, procedures, and detailed analyses are identified. The report finds that small amounts of chlorinated dibenzo-p-dioxins and dibenzofurans are emitted from many combustion sources, with only a few sources emitting larger amounts. These sources include municipal waste incinerators, secondary copper smelters and sewage sludge incinerators.

12455 **(PB—88-107818/XAB) Results of air sampling from selected asbestos-abatement projects.** Cain, W.C.; Powers, T.J.; Wilmoth, R.C. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). Sep 1987. 14p. (EPA—600/D-87/304). NTIS, PC A03/MF A01.

Results of asbestos-abatement monitoring at nine sites are discussed, comparing transmission-electron-microscopy analyses of post-abatement indoor levels with outdoor levels and comparing the t-test, z-test, and Wilcoxon test for clearance.

12456 **(PB—88-110978/XAB) Policies and procedures for control of indoor air quality. Final report, 1986-1987.** (National Research Council, Washington, DC (USA)). Jul 1987. 84p. NTIS, PC A05/MF A01.

Increasing incidents of discomfort or illness in the nonindustrial workplace that could often be traced to indoor-air-quality problems led to the study. Guidance is presented on how to identify and alleviate or prevent such problems. The primary focus on existing office buildings, although findings can be applied to other kinds of structures and to buildings being planned, constructed, or renovated. Suggestions are directed to facilities administrators, planners, designers, and managers as well as to maintenance and operating personnel, and to the building occupants themselves. The various factors that affect indoor air quality are described. These include thermal conditions, odors, irritants, toxic substances, and micro-organisms. Other issues that are not technically related to air quality but that may aggravate a situation are also discussed. Procedures for diagnosing and controlling problems include consideration of the structure itself, the ventilation system requirements and performance, and the conformance with established ventilation criteria. Several case studies illustrate typical problems and their solutions.

12457 **(PB—88-112164/XAB) Electrostatic-precipitator efficiency on a multiple-hearth incinerator burning sewage sludge.** Adams, R.C.; Bockol, G.; Maddox, J.A.; Robb, E.V. (Radian Corp., Research Triangle Park, NC (USA)). Sep 1987. 172p. NTIS, PC A08/MF A01.

A pilot-scale electrostatic precipitator (ESP) was evaluated for its removal performance of 23 metals and for sulfur-containing particles when fitted to a multiple hearth incinerator burning sewage sludge. The small-scale ESP was installed to take a slipstream of about 3% of the total incinerator emissions. Particle size fractions were collected from the gas streams entering and leaving the ESP. Each particle was evaluated for overall removal efficiency, size-fraction removal efficiency, and selective removal of specific metals. Total concentrations of each element in the controlled emission stream was determined as well as the proportionate concentration of species in the solid and volatile states. Concentrations of each metal in the emission stream were compared with the concentration in the sludge residue. To obtain comparisons of ESP performance with a more typical emission-control device, the performance of the incinerator's full-scale wet scrubber was also evaluated.

12458 **(PB—88-113188/XAB) National Air Toxics Information Clearinghouse: qualitative and quantitative carcinogenic risk assessment. Final report.** Cote, I.; Bayard, S. (Radian Corp., Research Triangle Park, NC (USA)). Jun 1987. 174p. (DCN—87-239-001-13-12). NTIS, PC A08/MF A01.

See also PB—87-125779.

This document describes the basic principles and assumptions associated with a qualitative and quantitative carcinogenic risk assessment and illustrates these features using several examples of quantitative risk assessment done by State and local agencies. The report is intended to help readers better understand and interpret a risk assessment rather than to provide instructions that would enable them to conduct a risk assessment. The report is aimed at managers and staff members in State and local agencies who are concerned with the use of qualitative and quantitative carcinogenic risk assessment for evaluating emissions of toxic air pollutants. The report discusses the four steps of risk assessment: hazard identification, dose-response assessment, exposure assessment, and risk characterization, focusing primarily on the dose-response assessment.

12459 **(PB—88-113196/XAB) National Air Toxics Information Clearinghouse: ongoing research and regulatory development projects, June 1987.** Hanson, M.L.; Brickley, C.B.; Pelland, A.S. (Radian Corp., Research Triangle Park, NC (USA)). Jun 1987. 107p. (DCN—87-239-001-23-08). NTIS, PC A06/MF A01.

See also PB—86-226396.

This document is divided into two parts and an appendix. The first part lists 235 air toxics projects currently in progress at EPA and NIOSH. A Brief description of each project and a contact name, office, and telephone number are given. The second part of the document contains the index that allows readers to locate projects of interest. Projects are indexed by agency, project type, chemical name, CAS number, and air pollution source type. The appendix lists regulatory development projects on toxic chemicals underway at the EPA's Office of Drinking Water (ODW). While most of these projects are not directly related to air problems, health information on toxic chemicals from ODW projects may be of interest to Clearinghouse users.

12460 **(PB—88-113246/XAB) Municipal landfill gas condensate.** Briggs, J. (SCS Engineers, Inc., Reston, VA (USA)). Oct 1987. 45p. NTIS, PC A03/MF A01.

New regulations relative to air emissions from municipal landfills may require the installation of gas-collection systems at landfills. As landfill gas (LFG) is collected, water and other vapors in the gas condense in the system or are purposely removed in the normal treatment of the gas. Condensate production can amount to more than 5000 liters per day consisting of two liquid phases: an aqueous phase and a hydrocarbon phase. The study involved the collection and analysis of condensate samples from four U.S. landfill sites with active gas migration or gas-production systems. The characteristics of both the hydrocarbon phase and the aqueous phase of the condensate were compared against USEPA hazardous-waste criteria. Results indicated that neither phase exhibited properties of corrosivity or reactivity. However, the hydrocarbon was ignitable, as was the aqueous phase in one sample. No pesticides, PCBs or priority-pollutant metals were detected in any sample. A list was developed of 94 organic compounds found in LFG condensate, 49 of which are priority-pollutant compounds.

12461 **(PB—88-113253/XAB) Experimental and modeling study of the photochemical reactivity of heatset printing oils. Final report.** Carter, W.P.L. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Oct 1987. 137p. NTIS, PC A07/MF A01.

A series of chamber experiments and computer-model simulations were carried out to assess the atmospheric-ozone-formation potential of the heatset printing oils Magie-47 and Magie-470 relative to that of ethane. A representative major constituent of these oils, n-pentadecane, was also studied. Results showed that n-pentadecane and the printing oils tend to slow down the initial rate of ozone formation in NOx-air irradiations, but they also caused higher final ozone yields in some surrogate-NOx-air experiments. The model was used to estimate the reactivities of ethane and n-pentadecane for several idealized model scenarios representing urban air pollution episodes. The predicted atmospheric reactivities of n-pentadecane and the printing oils relative to ethane were found to be highly dependent on the conditions of the model scenario. Thus, decisions on whether regulation of emissions of printing oils is beneficial in reducing atmospheric ozone must take into account the range of conditions of the air sheds into which they are emitted.

12462 **(PB—88-113261/XAB) User's guide for RAM. Second edition.** Catalano, J.A.; Turner, D.B.; Novak, J.H. (Aerocomp, Inc., Costa Mesa, CA (USA)). Oct 1987. 203p. NTIS, PC A10/MF A01.

See also PB—294-791.

RAM is an air-quality model based on the Gaussian-plume simplication of the diffusion equation which assumes time independence in the input meteorology and concentration. The model is primarily used to determine short-term (one hour to one day) concentrations from point and area sources. A maximum of 250 point sources and 100 area sources can be considered to yield pollutant concentrations at a maximum of 180 receptors. The simulation is done using hourly meteorological data for periods ranging from one hour to one year. A default option is available in the model for regulatory applications. Use of this option automatically sets certain parameters to preassigned values for consistency with the Guideline on Air Quality Models (Revised) (EPA, 1986).

12463 **(PB—88-113279/XAB) Air-quality considerations in the design of intermittent cut-and-cover highway tunnels. Final report, August 1983-November 1984.** Dayman, B.; Rubenstein, L.D. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1987. 159p. (JPL-D—4805). NTIS, PC A08/MF A01.

This document summarizes the experimental studies carried out for predicting air quality in and about passively-ventilated (no mechanical ventilation), intermittently-covered highways (such as cut-and-cover freeways). The information is presented in a handbook manner so it can readily be used by highway planners and de-

signers to estimate the distribution of the concentrations of vehicle exhaust for many types of multiple-tunnel highway system designs. The results of the report can be used to lower the acquistion, construction, and/or operation costs of freeways in central business districts by making more feasible the use of intermittent, unventilated, multiple tunnels as opposed to ventilated tunnels or open cuts. All this can be accomplished while minimizing: adverse effects of a freeway dividing and/or interrupting the established traffic/pedestrian patterns of an urban area; loss of the tax base.

12464 **(PB—88-113329/XAB) Evaluation of encapsulants for sprayed-on asbestos-containing materials in buildings.** Mirick, W.; Schmidt, E.W.; Melton, C.W.; Anderson, S.J.; Nowacki, L.J. (Battelle Columbus Labs., OH (USA)). Oct 1987. 118p. NTIS, PC A06/MF A01.

About 150 water-based liquid coatings sprayable by conventional airless paint-spraying equipment were applied to two-inch-thick sprayed mineral wool test matrices mounted overhead. After curing, specimens of the encapsulated test matrix were tested for fire resistance, flame spreading index, smoke, and toxic-gas release. Cohesive and adhesive strengths were measured as well as impact resistance. Thirteen materials met all of the criteria established for satisfactory performance and twenty-one others met most of the criteria.

12465 **(PB—88-113386/XAB) Urban air toxics monitoring program.** (Engineering-Science, Inc., Cary, NC (USA)). Sep 1987. 22p. NTIS, PC A03/MF A01.

To assist states and local agencies, EPA has developed a program to address the status of the air toxics problem in their localities. The document provides a description of (1) the program, (2) support EPA will provide to participating agencies, and (3) the responsibilities of state and local agencies.

12466 **(PB—88-113428/XAB) National Air Toxics Information Clearinghouse: NATICH data base report on state, local, and EPA (Environmental Protection Agency) air toxics activities, July 1987. Final report.** (Radian Corp., Austin, TX (USA)). Jul 1987. 358p. (DCN—87-239-001-31-06). NTIS, PC A16/MF A01.

See also PB—87-125779.

This report disseminates information provided to the National Air Toxics Information Clearinghouse (NATICH) data base by State and local air agencies on their air toxics activities. The computer-generated report supersedes manually- and computer-prepared reports published in September 1984, March 1985, September 1985, and July 1986. The report includes a listing of State and local agencies that have provided information to the clearinghouse, air toxics contacts, regulatory program information, acceptable ambient concentration guidelines or standards and the bases of those guidelines/standards, pollutant research information, methods development activities, permitting information, source testing information, ambient monitoring information, emissions inventory information, and risk assessment information. Because of the large volume of data that now resides in the data base, the document reports only a subset of the permitting and source testing information.

12467 **(PB—88-113436/XAB) Environmental Protection Agency's risk assessment guidelines. Health risks of noncriteria pollutants.** Preuss, P.W.; Ehrlich, A.M. (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). 1987. 17p. (EPA—600/J-87/099). NTIS, PC A03/MF A01.

Pub. in Jnl. of the Air Pollution Control Association, Vol. 37, No. 7. 783-797(Jul 1987).

In recent years, the EPA has moved toward a risk-assessment/risk-reduction framework for making regulatory decisions. The Agency has taken a number of steps to assure the quality and consistency of the risk-assessment component of those decisions. The first, and perhaps most important of these steps, is the development of Agency-wide risk assessment guidelines. Five guidelines have been published. They are: carcinogenicity, mutagenicity, developmental toxicity, chemical mixtures, and exposure. The provisions of the five guidelines are discussed in the context of the four components of risk assessment. Other activities designed to assure quality and consistency in risk assessments, reduce uncertainty in risk assessment, ensure a more efficient information exchange about risk and risk assessment, and develop the appropriate oversight mechanisms are also discussed. These include additional guidelines, the Risk Assessment Forum, Risk Assessment Research, the Integrated Risk Information System, the Hazard Assessment Notification System, and the Risk Assessment Council.

12468 **(PB—88-113816/XAB) Research and development of methods for the engineering and control of toxic airborne effluents. Volume 1. Final report.** Chang, D.P.Y. (California Univ., Davis (USA). Dept. of Civil Engineering). Jun 1987. 193p. NTIS, PC A09/MF A01.

This report summarizes research into the incineration of hazardous wastes. University of California, Davis convened a panel of national experts to discuss principles of incineration and the use of surrogate compounds to measure the destruction and removal efficiencies of toxic and hazardous compounds. The investigators also examined incinerability ranking schemes for selected compounds to measure the difficulty of their thermal decomposition and to evaluate laboratory-type incinerators for experimental use.

12469 **(PB—88-113824/XAB) Research and development on methods for the engineering evaluation and control of toxic airborne effluents. Final report.** Bell, R.L.; Castronovo, C.L.; Laban, C.; Lindner, G.; Shonnard, D. (California Univ., Davis (USA). Dept. of Chemical Engineering). Jun 1987. 227p. NTIS, PC A11/MF A01.

See also PB—88-113816.

This report summarizes the transport phenomena of volatile organic compounds from crude-oil impoundments in sumps and presents a mathematical model for the isothermal transport of single components from the oil. The report also reviews emissions from land farming of petroleum residues and contains a section on the general origins and chemistry of petroleum.

12470 **(PB—88-114012/XAB) Sensitivity analysis and preliminary evaluation of RELMAP (Regional Lagrangian model of Air Pollution) involving fine and course particulate matter.** Eder, B.K. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1987. 89p. (EPA—600/3-87/034). NTIS, PC A05/MF A01.

In response to the new, size-discriminate federal standards for Inhalable Particulate Matter, the Regional Lagrangian Model of Air Pollution (RELMAP) was modified to include simple, linear parameterizations. As an initial step in the possible refinement, RELMAP was subjected to a sensitivity analysis in which the effect of inducing a +/- 50% change in the three major parameterizations (transformation rate and wet and dry deposition rates) involving the simulation of fine and coarse particulate matter was examined. Simulated concentrations of fine and coarse particulate matter proved to be most sensitive to the wet deposition of fine and coarse particulate matter, respectively; fine concentrations were somewhat sensitive to the transformation rate of sulfur dioxide SO_2 into sulfate SO_4^{2-}, and less sensitive to the wet deposition of SO_2, and the dry deposition of fine particulate matter and SO_2; and finally, coarse concentrations were somewhat sensitive to dry deposition of coarse particulate matter. In order to assess the model's abilities, and to determine just how accurately these new parameters simulate the actual physical and chemical processes of the atmosphere, RELMAP was evaluated for the summer of 1980 using emissions data from the NAPAP Version 5.0 emissions inventory, monitoring data from the Inhalable Particulate Network, and meteorological data from the National Climatic Data Center. Unfortunately, several obstacles limited the scope of the evaluation, the two most important being the omission of open-source emissions from the NAPAP inventory, and the spatial and temporal incompatibility of the IPN data. Given the nature of these deficiencies, it is not surprising the model significantly underpredicted the concentrations of fine and coarse particulate matter.

12471 (PB—88-114335/XAB) Current issues in atmospheric change. Final report. (National Academy of Sciences, Washington, DC (USA). Commission on Physical Sciences, Mathematics, and Resources). 1987. 45p. NTIS, PC A03/MF A01.

Summary and conclusions of a workshop held at Washington, DC. on October 30-31, 1986.

In response to questions about the effects of long-term, global-scale changes in the atmosphere raised in congressional hearings, a group of leading experts held a two-day workshop to survey the state of current knowledge about atmospheric changes and their implications. The review focuses on the sources, concentrations, and changes of those gases most directly linked to human activities, i.e., carbon dioxide, ozone, and the chlorofluorocarbons; the direct physical effects of changes in trace gases; and the impacts of rising concentrations of trace gases. The review discusses the uncertainties associated with the knowledge of current trends and possible future changes, including ozone trends and the Antarctic ozone hole, and the impacts of rising concentrations of trace gases.

12472 (PB—88-116504/XAB) Procedure for determining particulate emissions from steady processes. Albertyn, C.H. (Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group). Nov 1985. 187p. (CSIR-CENG—592). NTIS, PC E09/MF E09.

North American Continent sales only.

The Chemical Engineering Research Group (CERG) of the CSIR was asked by the Air Pollution Control Division of the Department of Health and Welfare to compile a set of isokinetic sampling procedures which would assist in establishing a uniform system for sampling particle-laden process streams in the Republic of South Africa. During more than 15 years of active sampling in just about all types of local industry, the CERG has developed sampling equipment and procedures that are sufficiently flexible to be adapted to the variety of situations prevailing in industry. Only through the application of uniform standards will it be possible to make valid comparisons between the measurements done by different sampling teams.

12473 (PB—88-117015/XAB) Illinois annual air-quality report, 1986. (Illinois Environmental Protection Agency, Springfield (USA). Div. of Air Pollution Control). Jun 1987. 138p. (IEPA/APC—87-008). NTIS, PC A07/MF A01.

See also report for 1985, PB—86-216140.

The document summarizes ambient air-quality measurements obtained in Illinois during the calendar year of 1986. The report discusses air-quality data obtained for each site, provides statistical summaries, details air-quality violations, and provides trend data where available. Background information is included concerning sources of air pollutants, health effects, air-quality standards, and ambient monitoring methodologies.

12474 (PB—88-118476/XAB) Continuous-emission-monitoring sytems subset (CEMSS) user's guide. Final report. Bowers, R.O. (TRC Environmental Consultants, Inc., East Hartford, CT (USA)). May 1987. 347p. NTIS, PC A15/MF A01.

This guide provides instructions for use of the Continuous Emission Monitoring Systems Subset (CEMSS), a data base installed on the EPA NCC IBM computer. Also, major CEMS policy documents are reproduced. Continuous Emissions Monitoring System (CEMS) programs provide the basis for the most-comprehensive source surveillance networks available to the U.S. Environmental Protection Agency (EPA). The Stationary Source Compliance Division (SSCD), EPA's Regional Offices, and State and local agencies must implement an effective and successful CEMS program for numerous categories of pollutant source. These consist of several New Source Performance Standards (NSPS) sources categories and four categories of State Implementation Plan (SIP) sources. The SIP sources include fossil fuel-fired steam generators, sulfuric and nitric acid plants, and petroleum refineries. A partial listing of CEMS regulations can be found in Pate.

12475 (PB—88-120704/XAB) National Dioxin Study Tier 4 - combustion sources: engineering analysis report. Final report. Miles, A.J.; Keating, M.H.; Jamgochian, C.L. (Radian Corp., Research Triangle Park, NC (USA)). Sep 1987. 370p. NTIS, PC A16/MF A01.

This report summarizes the complete results of Tier 4 (combustion sources) of the National Dioxin Study. The purpose of the Tier 4 study was to address the following questions: Do combustion sources emit dioxin. If so, how much. Are these emissions significant. A secondary objective was to attempt to determine what combustion parameters affect dioxin emissions and to determine the effectiveness of conventional control devices for controlling dioxin emissions. The report presents the results of a literature review containing 249 references, the results of a stack-sampling program, and the results of an ash-sampling program. The stack-sampling program produced valid data from 12 sites covering 8 combustion-source categories. Data are presented for dioxin (tetra through octa homologue + 2378-TCDD) and furan (tetra through octa homologue + 2378-TCDF) emissions as well as combustion conditions. Where possible, data were obtained before and after control devices. Ash samples were collected from 74 sites covering 22 combustion source categories. Dioxin and furan data are presented for the ash data. Various data correlations are presented.

12476 (PB—88-128517/XAB) National Acid Precipitation Assessment Program (NAPAP) Interim Assessment: the causes and effects of acidic deposition. (National Acid Precipitation Assessment Program, Washington, DC (USA)). 1987. 946p. NTIS, PC E99.

Set includes PB—88-128525 through PB—88-128558.

A separate abstract was prepared each of the four volumes of this set.

12477 (PB—88-128525/XAB) National Acid Precipitation Assessment Program (NAPA) Interim Assessment: the causes and effects of acidic deposition. Volume 1. Executive summary. (National Acid Precipitation Assessment Program, Washington, DC (USA)). 1987. 114p. NTIS, PC A06/MF A01.

See also Volume 2, PB—88-128533. Also available from Supt. of Docs.; Also available in set of 4 reports PC E99, PB—88-128517.

This is a synopsis of the material covered in the technical volumes of the NAPAP Interim Assessment. It includes major conclusions from research in the substantive areas of current and historical emissions, control technologies, future emissions, atmospheric processes, acidic deposition and air quality, crop effects, forest effects, effects on aquatic systems, effects on materials, and effects on human health and visibility. Also, it discusses the NAPAP organizational structure, its history, and role in the understanding of the acidic-deposition phenomenon.

12478 (PB—88-128533/XAB) National Acid Precipitation Assessment Program (NAPAP) Interim Assessment: the causes and effects of acidic deposition. Volume 2. Emissions and control. (National Acid Precipitation Assessment Program, Washington, DC (USA)). 1987. 247p. NTIS, PC A11/MF A01.

See also Volume 1, PB—88-128525 and Volume 3, PB—88-128541. Also available from Supt. of Docs.; Also available in set of 4 reports PC E99, PB—88-128517.

This volume on Emissions and Controls is the second in a four-volume set which comprises the NAPAP Interim Assessment. It contains three chapters, (1) Historical Emissions, (2) Emission Control Technologies, and (3) Future Emissions. Volume III, Atmospheric Processes and Deposition, contains chapters on (4) Atmospheric Processes, and (5) Acidic Deposition and Air Quality. The last volume, entitled, Effects of Acidic Deposition, covers (6) Agricultural Crops, (7) Forests, (8) Aquatics Systems, (9) 'Materials, and (10) Human Health and Visibility. Each of these chapters describes the National Program's research orientation and major conclusions within each of the ten primary areas of substantive concern. In order to learn how these first-order conclusions relate to the issue of acidic deposition in an overall, or synoptic, sense, the reader is directed to Volume I, Executive Summary, where the conclusions from each of the ten chapters are distilled in a manner

that will allow interested parties to quickly reference the status of a variety of factors that pertain to the scientific understanding of acidic deposition.

12479 **(PB—88-128541/XAB) National Acid Precipitation Assessment Program (NAPAP) Interim Assessment: the causes and effects of acidic deposition. Volume 3. Atmospheric processes.** (National Acid Precipitation Assessment Program, Washington, DC (USA)). 1987. 222p. NTIS, PC A10/MF A01.

See also Volume 2, PB—88-128533 and Volume 4, PB—88-128558. Also available from Supt. of Docs.; Also available in set of 4 reports PC E99, PB—88-128517.

This volume on Atmospheric Processes and Deposition is the third in a four volume set which comprises the NAPAP Interim Assessment. It contains two chapters dealing with (4) Atmospheric Processes, and (5) Acidic Deposition and Air Quality. Volume II, Emissions and Controls, contains chapters on (1) Historical Emissions, (2) Emission Control Technologies, and (3) Future Emissions. Volume IV, Effects of Acidic Deposition, contains chapters on (6) Agricultural Crops, (7) Forests, (8) Aquatic Systems, (9) Materials, and (10) Human Health and Visibility. Each of these chapters describes the National Program's research orientation and major conclusions within each of the ten primary areas of substantive concern. In order to learn how these first-order conclusions relate to the issue of acidic deposition in an overall, or synoptic, sense the reader is directed to Volume I, Executive Summary and Major Conclusions, where the conclusions from each of the ten chapters are distilled in a manner that will allow interested parties to quickly reference the status of a variety of factors that pertain to the scientific understanding of acidic deposition.

12480 **(PB—88-128558/XAB) National Acid Precipitation Assessment Program (NAPAP) Interim Assessment: the causes and effects of acidic deposition. Volume 4. Effects of acidic deposition.** (National Acid Precipitation Assessment Program, Washington, DC (USA)). 1987. 363p. NTIS, PC A16/MF A01.

See also Volume 3, PB—88-128541. Also available from Supt. of Docs.; Also available in set of 4 reports PC E99, PB—88-128517.

This volume on Effects of Acidic Deposition is the last in a four-volume set which comprises the NAPAP Interim Assessment. It contains five individual chapters covering (6) Agricultural Crops, (7) Forests, (8) Aquatic Systems, (9) Materials, and (10) Human Health and Visibility. Volume III, Atmospheric Processes and Deposition, has two chapters on (4) Atmospheric Processes, and (5) Acidic Deposition and Air Quality. Volume II, Emissions and Controls, contains three chapters on (1) Historical Emissions, (2) Emission Control Technologies, and (3) Future Emissions. Each of these chapters describes the National Program's research orientation and major conclusions within each of the ten primary areas of substantive concern. In order to learn how these first-order conclusions relate to the issue of acidic deposition in an overall, or synoptic, sense, the reader is directed to Volume I, Executive Summary, where the conclusions from each of the ten subject chapters are distilled in a manner that will allow interested parties to quickly reference the status of a variety of factors that pertain to the scientific understanding of acidic deposition.

12481 **(PB—88-132964/XAB) Characterization of emission sources into the indoor environment. Appendix volume to final report, March 1982-March 1985. Draft report.** Moschandreas, D.J.; Relwani, S.; O'Neill, H.J.; Cole, J.T.; Elkins, R.H. (IIT Research Inst., Chicago, IL (USA)). Mar 1985. 238p. NTIS, PC A11/MF A01.

See also report dated Mar 1985, PB—86-103900.

The appendix to the final report on Characterization of Emission Sources in the Indoor Environment provides the experimental protocols for sampling and data analysis; emission rates of CO, NO, NO_2, and NOx from range-top burners as calculated from mass balance experiments; statistical charts and tables; calibration curves for CO, NOx, CO_2, SO_2, and hydrocarbons; quality-assurance procedures for monitoring of CO and oxides of nitrogen; and ion chromatograms for background and samples analyzed for VOC emission from range-top burners.

12482 **(PB—88-853924/XAB) Odor pollution. January 1977-November 1987 (citations from the NTIS data base). Report for January 1977-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 92p. NTISPC N01/MF N01.

Supersedes PB—86-862000.

This bibliography contains citations concerning odorous air pollutants, and odors and tastes in water. Sources include agricultural and livestock wastes, sewage sludge, industrial wastes, vehicular exhausts, hospitals, and polluted-water streams. Treatment methods, environmental protection aspects, and human factors are discussed. (This updated bibliography contains 168 citations, 23 of which are new entries to the previous edition.)

12483 **(PB—88-853957/XAB) Particle-size analysis. January 1974-November 1987 (citations from the International Aerospace Abstracts data base). Report for January 1974-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 143p. NTISPC N01/MF N01.

Supersedes PB—86-865607; U.S. sales only.

This bibliography contains citations concerning the determination and analysis of particles and particle-size of atmospheric pollutants, aerosols, and powders. Techniques and instrumentation for measuring particle size, mass and concentration are considered. Particle size analysis related to meteorology, solar radiation, and atmospheric pollution are discussed. (This updated bibliography contains 318 citations, 25 of which are new entries to the previous edition.)

12484 **(PNL—6377) User's guide to a data base of current environmental monitoring projects in the US-Canadian transboundary region.** Ballinger, M.Y.; Defferding, J.; Chapman, E.G.; Bettinson, M.D.; Glantz, C.S. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88002476/JAW.

This document describes how to use a data base of current transboundary region environmental monitoring projects. The data base was prepared from data provided by Glantz et al. (1986) and Concord Scientific Corporation (1985), and contains information on 226 projects with monitoring stations located within 400 km (250 mi) of the US-Canadian border. The data base is designed for use with the dBASE III PLUS data management systems on IBM-compatible personal computers. Data-base searches are best accomplished using an accompanying command file called RETRIEVE or the dBASE command LIST. The user must carefully select the substrings on which the search is to be based. Example search requests and subsequent output are presented to illustrate substring selections and applications of the data base. 4 refs., 15 figs., 4 tabs.

12485 **(PNL-SA—14287) A comparison of multi-layer meso-alpha MLAM model results with surface and aircraft observations from CAPTEX.** Davis, W.E.; Olsen, A.R.; Didier, B.T.; Damschen, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1987. Contract AC06-76RL01830. 12p. (CONF-870444—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88000549/JAW.

From 16. international technical meeting on air pollution modelling and its application; Lindau, F.R. Germany (6 Apr 1987).

A multi-layer regional-scale transport model with vertical motion, MLAM, was modified to run on the meso-alpha scale. The model was run on this scale to test the effects of wind shear and vertical redistribution due to mixing in the model against the observed surface and aircraft air concentrations. The CAPTEX (Cross Appalachian Tracer Experiment) data base was chosen because both surface and aircraft observations were available to compare with model results. Two CAPTEX cases were studied. Aircraft observations for one case showed an elevated plume with concentrations approximately 10 to 30 times greater aloft than at the surface. The second case was chosen because the plume spread less than the first case. Comparisons between the model results and observations in these two cases provide a means of testing the effect of shear and redistribution. 5 refs., 11 figs.

12486 (PNL-SA—14703) Model investigations of atmospheric ammonia scavenging. Laulainen, N.S.; Luecken, D.J.; Hales, J.M. (Pacific Northwest Lab., Richland, WA (USA)). May 1987. Contract AC06-76RL01830. 28p. (CONF-8704227—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002337/JAW.

From International symposium on ammonia and acidification; Bilthoven, Netherlands (14 Apr 1987).

In this study, a one-dimensional reactive storm model was used to calculate vertical concentration profiles of atmospheric ammonia and to examine the behavior of these concentrations during precipitation events. The model was initially used to generate clear-air profiles that were found to be consistent with those reported in the literature. A simple, convective storm was then applied to these initial profiles to determine the response of the gaseous ammonia concentrations to the precipitation event. The vertical ammonia concentrations were found to be significantly depleted by the storm event, with the maximum depletion occurring in the cloud layer. This alteration can have potentially significant effects in calculated reaction rates and in the upward flux of ammonia to the stratosphere. Several different storm conditions were tested, and all cases displayed the same characteristic depleted profiles. Calculations were performed for gaseous and aqueous ammonia only to assess the usefulness of this method for determining the depletion of highly soluble atmospheric gases and to specify the minimum amount of gaseous ammonia depletion occurring during a precipitation event. 17 refs., 7 figs., 1 tab.

12487 (UCRL—97172) FEM3 modeling of ammonia and hydrofluoric acid dispersion. Chan, S.T.; Rodean, H.C.; Blewitt, D.N. (Lawrence Livermore National Lab., CA (USA); Amoco Corp., Chicago, IL (USA)). Jul 1987. Contract W-7405-ENG-48. 40p. (CONF-871172—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001897/JAW.

From Conference on vapor cloud modeling; Boston, MA, USA (2 Nov 1987).

FEM3 is a three-dimensional computer model that was designed to simulate the atmospheric dispersion of heavier-than-air gas releases. Recently a phase-change submodel based on local thermodynamic equilibrium has been implemented to treat vapor-liquid transition of the dispersed material. A preliminary evaluation of the phase-change submodel was performed by using data obtained from two recently conducted series of field experiments, namely, the pressurized ammonia spills conducted by LLNL and the anhydrous hydrofluoric acid dispersion experiments conducted by Amoco Oil Company and LLNL. FEM3 results compare reasonably well with the good data available from one ammonia spill and two hydrofluoric acid spills and, in particular, the results obtained by using the phase-change submodel represent considerable improvements over those from all-vapor simulations. While the present phase-change submodel qualitatively handles the aerosol effects, including gravity flow and heat transfer between the vapor and droplets, it tends to over-estimate the rate of droplet evaporation. 16 refs., 12 figs., 7 tabs.

12488 (VW-FMT—8608-V/5) Aldehyde and ethanol contamination from vehicles driven by ethanol in narrow streets. Kraft, J.; Kuhler, M. (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.). Abt. Forschung und Entwicklung). 15 Dec 1986. 36p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751243/JAW.

The present state of knowledge concerning the effects of aldehydes and ethanol on humans and the human environment is reviewed. Acetaldehyde is considered relatively harmless. Poisoning by inhalation and percutaneous resorption of ethanol vapour is not possible in practice, as ethanol is resorbed more slowly than it is decomposed in the body. Spread calculations with a model of a narrow street for two busy streets (Sao Paulo, Brazil, street profiles) showed formaldehyde immission concentrations, which are considerably below the recommended limit of the Federal Health Office of 0.1 ppm of formaldehyde for living rooms and even more below the MAK value (maximum workplace concentration) and TLV (US threshold limit value) of 1 ppm of formaldehyde for workplaces. The immission concentrations calculated according to this model for ethanol and acetaldehyde also fall below the MAK values of 1000 ppm for ethanol and 50 ppm for acetaldehyde by several orders of magnitude. The tropospheric decomposition of ethanol and acetaldehyde plays a particular part in the chemistry of the polluted atmosphere. As the ethanol and acetaldehyde immission concentrations determined here are very low, the contribution to the formation of photo-oxidants is also correspondingly low.

12489 Model for adsorption capacities of charcoal beds. II. Challenge concentrations effects. Wood, G.O. (Los Alamos National Lab., NM). *American Industrial Hygiene Association Journal;* 48: No. 8, 703-709(Aug 1987).

Equilibrium and kinetic capacities of charcoal beds for adsorbed toxic gases and vapors depend on the concentrations of those gases and vapors. Water vapor also affects these capacities. The assumption of competitive (vapor vs. water vapor) equilibria for adsorption led to a mathematical model that quite successfully described relative humidity effects on adsorption capacities of water immiscible vapors. This same model now has been demonstrated to describe published and new data on vapor concentration effects equally well. Parameters obtained from fits of experimental data with the model can be used for comparisons of charcoal characteristics, adsorbate-charcoal interactions and water-charcoal interactions. Correlations by this model are useful for extrapolating data to untested vapor concentrations and relative humidity conditions.

12490 Model for adsorption capacities of charcoal beds. I. Relative humidity effects. Wood, G.O. (Los Alamos National Lab., NM). *American Industrial Hygiene Association Journal;* 48: No. 7, 622-625(Jul 1987).

Water vapor is the major interferent in the adsorption of other vapors from air when that air is passed through an activated charcoal bed. A limited amount of data is available on the magnitudes of capacity (or service life) reduction as a function of relative humidity and preadsorbed water. A simple equilibrium model has been developed that quantitatively explains observed humidity effects and allows extrapolation of data to untested conditions.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11052, 11507, 11524, 11555, 11558, 12499, 12500, 12522, 12660, 12664, 12685, 13488

12491 (INIS-mf—11081, pp 82-136) Monitoring of environmental radioactivity. 1986. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700823/JAW.

In Development of radiation hygiene in Western Slovakia in the years 1958-1984.

The results are described of monitoring radioactivity of atmospheric fallout, surface waters, soils, plant feeds, cereals, and other agricultural produce. The results were obtained over a long time period. Radioactivity was also measured of milk, milk products, vegetables and fruits, meat and hen eggs, flour and bakery products with a view to radionuclide migration in the food chain. The daily intake of /sup 90/Sr and /sup 137/Cs from food was determined from the values obtained and the consumption of the individual types of food. Strontium-90 distribution was studied in the bones and the teeth of the population in Slovakia. With the commissioning of nuclear power plants, emissions and liquid wastes were monitored and their environmental impact assessed. (E.S.).

12492 (INIS-mf—11081) Development of radiation hygiene in Western Slovakia in the years 1958-1984. Csupka, S.; Carach, J.; Petrasova, M.; Gaal, P.; Stojkovic, J. (Krajska Hygienicka Stanica, Bratislava (Czechoslovakia)). 1986. 175p. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700823/JAW.

English translation available from Nuclear Information Center, 156 16 Prague 5-Zbraslav, Czechoslovakia at US$ 10 per page. .

A detailed description is presented of the activities of the radiation hygiene division in the years 1958-1984. Statistical data are listed on the number of personnel, of measurements performed and workplaces and localities inspected. The activities are reviewed of the division in nuclear power plant surveillance, environmental radioactivity monitoring, and radioactivity monitoring in the foods,

soil, air and human organism. The events are described of some interventions of the division, e.g., searches of lost radiation sources, etc. (M.D.) 35 figs., 70 tabs., 30 refs.

12493 **(NUREG/CR—4950-Vol.2) The Shoreline Environment Atmospheric Dispersion Experiment (SEADEX): Meteorological and gas tracer data.** Johnson, W.B.; Cantrell, B.K.; Morley, B.M.; Uthe, E.E.; Nitz, K.C. (SRI International, Menlo Park, CA (USA)). Oct 1987. Contract W-31109-ENG-38. 493p. NTIS, PC A21/MF A01 - GPO. Order Number TI88002419/JAW.

The SEADEX atmospheric dispersion field study was conducted during the period May 28 to June 8, 1982, in northeastern Wisconsin, the vicinity of the Kewaunee Power Plant on the western shore of Lake Michigan. The specific objectives of SEADEX were to characterize (1) the atmospheric dispersion and (2) the meteorological conditions influencing this dispersion as completely as possible during the test period. This field study included a series of controlled tracer tests utilizing state-of-the-art tracer measurement technology to determine horizontal and vertical dispersion over both land and water. Extensive meteorological measurements were obtained to thoroughly characterize the three-dimensional structure of the atmospheric boundary controlling the dispersion process. This volume presents the meteorological and gas tracer data collected during the field study. 391 figs., 32 tabs.

12494 **(PB—88-111067/XAB) Summary of state radon programs. Final report.** (Office of Radiation Programs, Washington, DC (USA)). Aug 1987. 48p. (EPA—520/1-87/19-1). NTIS, PC A03/MF A01.

This report describes the range of state radon activities underway, the administrative and legislative mechanisms used to support these activities, and the resources devoted to them. The report focuses on the scope and magnitude of the radon program within each state, rather than on the radon problem and how to address it. Hence, the report is not a comprehensive source of technical information, nor a source of measurement or mitigation results.

12495 **(PB—88-117981/XAB) Summary of state radon programs. Appendix. Final report.** (Office of Radiation Programs, Washington, DC (USA)). Aug 1987. 288p. (EPA—520/1-87/19-2). NTIS, PC A13/MF A01.

See also PB—88-111067.

This report describes the range of state radon activities underway, the administrative and legislative mechanisms used to support these activities, and the resources devoted to them. The report focuses on the scope and magnitude of the radon program within each state, rather than on the radon problem and how to address it. Hence, the report is not a comprehensive source of technical information, nor a source of measurement or mitigation results.

12496 **(RL—143-84) /sup 3/H, /sup 14/C, /sup 85/Kr and /sup 129/I production in nuclear facilities. Release from reactory and transfer to reprocessing.** Castellani, F.; Ocone, R. (Pisa Univ., Italy. Ist. di Impianti Nucleari). (Pisa Univ. (Italy). Dipt. di Costruzioni Meccaniche e Nucleari). 1984. 71p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701404/JAW.

The production of /sup 3/H, /sup 14/C, /sup 85/Kr and /sup 129/I in nuclear power plants is evaluated. In particular the plant components where these radioisotopes can be formed and the formation processes, with corresponding cross sections, are considered. Furthermare their release in the plants and the fraction transfered to the reprocessing are examined.

12497 **(SCPRI-RM—4-1987) Monthly results of measurements April 1987.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). May 1987. 49p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751429/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

12498 **Aerodynamic size associations of ^{212}Pb and ^{214}Pb in ambient aerosols.** Papastefanou, C.; Bondietti, E.A. (Oak Ridge National Lab., TN). *Health Physics;* 53: No. 5, 461-72(Nov 1987).

The aerodynamic size distributions of short-lived Rn daughters (reported as ^{214}Pb and ^{212}Pb) in ambient aerosol particles were measured using low-pressure as well as conventional low-volume and high-volume impactors. The activity distribution of ^{214}Pb and ^{212}Pb, measured by alpha spectroscopy, was largely associated with submicron aerosols in the accumulation mode (0.08 to 2 microns). The activity median aerodynamic diameter ranged from 0.09 to 0.37 micron (mean 0.16 micron) for ^{214}Pb and from 0.07 to 0.25 micron (mean 0.13 micron) for ^{212}Pb. The mean values of the geometric standard deviation (sigma g) were 2.97 and 2.86, respectively. By comparison, the median diameters of cosmogenic ^{7}Be and ambient SO_4(2-) were about 0.24 micron higher. In almost 70% of the low-pressure impactor measurements, the activity distribution of ^{214}Pb showed a small shift to larger particle sizes relative to ^{212}Pb. This shift probably results from alpha-recoil detachment of parent ^{218}Po, which preferentially depletes ^{214}Pb from smaller particles. The subsequent recondensation of ^{214}Pb causes an enrichment of larger aerosols. Early morning and afternoon measurements indicated that similar size associations of ^{214}Pb occur, despite humidity differences and the potential for fresh particle production in the afternoon. Health physics implications of the results are also discussed.

5005 Site Resource And Use Studies

12499 **(DOE/NV/10327—33) Radiological effluent and onsite area monitoring report for the Nevada Test Site (January 1986-December 1986).** Gonzalez, D.A. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA). Environmental Sciences Dept.). Sep 1987. Contract AC08-84NV10327. 220p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88002434/JAW.

This report documents the environmental surveillance program at the Nevada Test Site as conducted by the Department of Energy (DOE) onsite radiological safety contractor from January 1986 through December 1986. It presents results and evaluations of radioactivity measurements in air and water, and of direct gamma radiation exposure rates. It establishes relevant correlations between the data recorded and DOE concentration guides (CG's). External gamma exposure levels and radioactivity in air and water on the Nevada Test Site were low compared to DOE guidelines. The highest average gross beta concentration in air was 0.005% of the DOE concentration guide (CG). The highest average Pu-239 concentration was 7.7% of the standard. The highest average tritium concentration was 0.39% of the standard. Kr-85 concentrations increased slightly from CY-1985 to CY-1986. Xe-133 remained nondetectable with some exceptions. The highest average gross beta concentration in potable water remained within the applicable standard for drinking water. The highest average Pu-239 concentration from contaminated waters was 0.0005% of the concentration guide. The highest average tritium concentration in noncontaminated water was 6% of the level for drinking water required by the National Interim Primary Drinking Water Regulation. The amounts of tritium-bearing effluent released to contaminated waste ponds was calculated and reported to DOE Headquarters. Gamma radiation measurements were roughly the same in CY-1986 relative to the previous year. All surveillance results from the Radioactive Waste Management Site (RWMS) indicate that no detectable releases of radioactive materials occurred in that network in 1986. 29 refs., 14 figs., 23 tabs.

12500 **(LA—11150-MS) Measurement and modeling of external radiation during 1985 from LAMPF [Los Alamos Meson Physics Facility] emissions.** Bowen, B.M.; Olsen, W.A.; Chen, Ili; Van Etten, D.M. (Los Alamos National Lab., NM (USA)). Nov 1987. Contract W-7405-ENG-36. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002322/JAW.

An array of three portable, pressurized ionization chambers (PICs) continued to measure external radiation levels during 1985 caused by radionuclides emitted from the Los Alamos Meson Physics Facility (LAMPF). A Gaussian-type atmospheric dispersion model, using onsite meteorological and stack release data, was tested during this study. A more complex finite model, which takes into account the contribution of radiation at a receptor from different locations of the passing plume, was also tested. Monitoring results indicate that, as in 1984, a persistent wind up the Rio Grande Valley during the evening and early morning hours is largely responsible for causing the highest external radiation levels to occur to the northeast and north-northeast of LAMPF. However, because of increased turbulent mixing during the day, external radiation levels are generally much less during the day than at night. External radiation levels during 1985 show approximately a 75% reduction over 1984 levels. This resulted from a similar percentage reduction in LAMPF emissions caused by newly implemented emission controls. Comparison of predicted and measured daily external radiation levels indicates a high degree of correlation. The model also gives accurate estimates of measured concentrations over longer time periods. Comparison of predicted and measured hourly values indicates that the model generally tends to overpredict during the day and underpredict at night. 9 refs., 14 figs., 13 tabs.

5006 Regulations

REFER ALSO TO CITATION(S) 11756, 11757, 11762, 12413, 12459, 12466, 12467, 12473, 12593

12501 (AD-A—185031/2/XAB) Environmental Impact Atatement for the new San Clemente Project, Monterey County, California - Regulatory Permit Application Number 16516s09. Appendices. Draft environmental impact report. (Corps of Engineers, San Francisco, CA (USA). San Francisco District). Sep 1987. 212p. NTIS, PC A10/MF A01.

Appendices to AD-A185 030.

This report consists of six Appendices. Topics include: Description of Carmel Valley simulation model; List of technical support documents; Avian survey and bird list; reptile and amphibian list; mammal list; plant list; riparian zone mitigation plan; State and federal air quality standards; Population and employment projections; Archaeological report.

12502 (IIUG/dp—86-9) Clean air policy in Europe: A survey of 17 countries. Weidner, H. (Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). 1986. 90p. (In English, German and French). Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft.

After a brief retrospective on the important stages of development of clean air policy in Europe, a description is undertaken of the areas and countries in which progress has been made or where great problems still exist. Because in the case of transboundary air pollution only pan-European clean air policy can achieve the desired pollution abatement, it will be necessary to agree on unitary criteria for setting targets and measuring compliance and results. The present contribution includes proposals for doing this. Extensive tables contain central information and data which are important for assessing the clean air policies of 17 countries.

12503 (NP—8751232) Research in North-Rhine Westphalia. Environmental research in 1986 - a documentation. (Ministerium fuer Wissenschaft und Forschung des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). 1987. 399p. (In German). NTIS (US Sales Only), PC A17. Order Number DE88751232/JAW.

Environmental research within the meaning of this documentation is any research aiming predominantly at reducing, avoiding, or removing environmental pollution. The documentation includes especially projects of relevance to technology and economy, natural science, biology, planning, medicine, and pedagogy. For the period of report January 1984 to February 1986, nearly 500 research projects of environmental relevance were made out at the scientific institutions of the country. Some 230 research groups and institutions are intensively studying questions relating to cyclones for dust separation, from their analytics to their use. The 13 sectors covered are: Forest die-back; planning; open areas; noise in residential areas; clean air; conservancy of nature and species; soil; foodstuffs; waters; waste; medicine and toxicology; analytics; topics of a general nature. (HSCH).

12504 (PB—88-101613/XAB) Program strategies for standards development for hazardous-waste incineration. von Lehmden, D.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). Sep 1987. 16p. (EPA—600/D-87/274). NTIS, PC A03/MF A01.

The principal goal of the EPA Environmental Monitoring Systems Laboratory (EMSL) in assessing the quality of measurements is the development of accurate standards that may be used by agency personnel (federal, state, and local) to audit and assess the quality of measurements. EMSL's development of ppb cylinder gas standards, containing hazardous organic compounds, was initiated to meet the need for audit materials to assess the quality of trial-burn-test measurements during hazardous-waste incineration. The logic used in selecting organics for this standards development and the procedure used to ensure the highest possible accuracy in these standards are described. Also discussed is the apparent need for high-quality gas standards for ambient-air hazardous organic measurements and the extent to which the current inventory of 29 organic standards fulfills this need.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

REFER ALSO TO CITATION(S) 11978

5101 Basic Studies

REFER ALSO TO CITATION(S) 12898

12505 (CONF-8710173—1) Air Force geographic information and analysis system. Henney, D.A.; Jansing, D.S.; Durfee, R.C.; Margle, S.M.; Till, L.E. (Strategic Air Command, Offutt AFB, NE (USA); Civil Engineering Squadron, Sheppard AFB, TX (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001420/JAW.

From Geographic information system conference; San Francisco, CA, USA (27 Oct 1987).

A microcomputer-based geographic information and analysis system (GIAS) was developed to assist Air Force planners with environmental analysis, natural resources management, and facility and land-use planning. The system processes raster image data, topological data structures, and geometric or vector data similar to that produced by computer-aided design and drafting (CADD) systems, integrating the data where appropriate. Data types included Landsat imagery, scanned images of base maps, digitized point and chain features, topographic elevation data, USGS stream course data, highway networks, railroad networks, and land use/land cover information from USGS interpreted aerial photography. The system is also being developed to provide an integrated display and analysis capability with base maps and facility data bases prepared on CADD systems. 3 refs.

12506 (INP—1240/AP) Description of a neutron field perturbed by a probe using coupled Monte Carlo and discrete ordinates radiation transport calculations. Zazula, J.M. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 166p. (In Polish). NTIS (US Sales Only), PC A08/MF A01. Order Number TI88701344/JAW.

This work concerns calculation of a neutron response, caused by a neutron field perturbed by materials surrounding the source or the detector. Solution of a problem is obtained using coupling of the Monte Carlo radiation transport computation for the perturbed region and the discrete ordinates transport computation for the unperturbed system. (author). 62 refs.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10801, 10811, 11053, 11734, 12435, 12460, 12469, 12484, 12562, 12638

12507 (KFK-PEF—24) Results of precipitation analyses in south-west German forest ecosystems 1981-1986. Adam, K.; Evers, F.H.; Littek, T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). May 1987. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751229/JAW.

Analytical data of precipitation measured between 1982 and 1986 in 11 forest stands of Baden-Wuerttemberg is presented in a tabular summary. The following results were obtained: Proton input was most intensive in the western exposed slopes of the Black Forest and Odenwald (luff), eastern flank of the Rhine valley (deposition rates up to 3,3 kMol/ha/a). In the eastern parts of the Black Forest (lee), proton input was considerably less (≤ 1,5 kMol/ha/a). The lowest proton load was measured in the alpine foothills of South-West Germany. Nitrogen and heavy metal deposition also vary considerably. Generally, the western exposed slopes of the Black Forest and Odenwald show the highest input rate. With 75 tabs., 15 figs., 12 refs..

12508 (NP—8751002) Selected problems in forest soils. Nutrients, soil acidification, roots, damage. Dettwiler, J. (Bundesamt fuer Umweltschutz, Bern (Switzerland)). Oct 1986. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751002/JAW.

Different aspects of forest decline, especially soil processes are looked into. This is done by Swiss foresters, who are handling young and not acid soil. Their statements against fertilisation are explained.

12509 (PB—88-112297/XAB) Hazardous pollutants in Class II landfills. Research report (Final). Wood, J.A.; Porter, M.L. (South Coast Air Quality Management District, El Monte, CA (USA)). Dec 1986. 198p. NTIS, PC A09/MF A01.

The purpose of this study was to determine whether some contaminants, known to exist in landfills licensed to receive industrial wastes (Class I sites), were also found at landfills that receive ordinary trash (Class II sites). The District's Technical Services staff conducted a series of tests at 20 Class II sites beginning in 1984, and concluded that, although significant levels of vinyl chloride and benzene were found at many of those sites, the offsite ambient concentrations for vinyl chloride were well below the State ambient air-quality standard at five of them chosen for ambient testing. The study discusses a known action that takes place in landfills, whereby buried materials undergo bacterial decomposition and generate gases for decades after closure. Although that is a known phenomenon, what is still not known is how vinyl chloride was generated in these Class II landfills. The report also states that migrating methane could be a problem if this gas migrates beyond the landfill property line and becomes trapped in enclosed spaces, presenting a potential explosive hazard.

12510 (PB—88-118310/XAB) Soil processes at Emerald Lake Watershed. Final report. Lund, L.J.; Brown, A.D.; Lueking, M.A.; Nodvin, S.C.; Page, A.L. (California Univ., Riverside (USA). Dept. of Soil and Environmental Sciences). 20 Apr 1987. 129p. NTIS, PC A07/MF A01.

The objectives of the Soils Processes research at Emerald Lake Watershed (ELW) were to assess physical, chemical and biological processes contributing to the production or consumption of acidity in soils and to assess the net effect of soil processes on surface-water quality in an alpine watershed. Most of the N and S in ELW soils is stored in organic forms. Most of the soil P is present in nearly insoluble mineral forms. The ELW soils can adsorb only small quantities of sulfate, thus their capacity for buffering acid additions by sulfate adsorption is low. Concentrations of Al, Ca, Mg, K, and Na in both soil solution and stream samples reflected patterns of mineral weathering in the watershed. Summer CO_2 concentrations in the soils were high enough to increase soil solution acidity and influence the speciation of dissolved elements. The overall chemistry of stream waters reflects the mineral composition of soils and rocks at ELW.

12511 (PB—88-120597/XAB) Direct/Delayed Response Project: field operations and quality-assurance report for soil sampling and preparation in the northeastern United States. Volume 1. Sampling. Coffey, D.S.; Papp, M.L.; Bartz, J.K.; Van Remortel, R.D.; Lee, J.J. (Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA)). Sep 1987. 209p. NTIS, PC A10/MF A01.

See also Volume 2, PB—88-120605.

The Direct/Delayed Response Project Soil Survey includes the mapping, characterization, sampling, preparation, and analysis of soils in order to assess watershed response to acidic deposition within various regions of the United States. Soil samples collected by sampling crews in the Northeastern region were processed at preparation laboratories before being sent for analysis at analytical laboratories. Volumes I and II summarize the procedural and operational compliance with protocols used by the sampling crews and oy the preparation laboratories, respectively. Recommendations are made for program improvement.

12512 (PB—88-120605/XAB) Direct/Delayed Response Project: field operations and quality-assurance report for soil sampling and preparation in the northeastern United States. Volume 2. Preparation. Papp, M.L.; Van Remortel, R.D. (Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA)). Sep 1987. 152p. NTIS, PC A08/MF A01.

See also Volume 1, PB—88-120597.

The Direct/Delayed Response Project Soil Survey includes the mapping, characterization, sampling, preparation, and analysis of soils in order to assess waterahed response to acidic deposition within various regions of the United States. Soil samples collected by sampling crews in the Northeastern region were processed at preparation laboratories before being sent for analysis at analytical laboratories. Volumes I and II summarize the procedural and operational compliance with protocols used by the sampling crews and by the preparation laboratories, respectively. Deviations from protocols and difficulties encountered are identified and discussed.

12513 (PNL—6071) Evaluate and characterize mechanisms controlling transport, fate and effects of Army smokes in the aerosol wind tunnel: Transport, transformations, fate, and terrestrial ecological effects of red phosphorus-butyl rubber and white phosphorus obscurant smokes: Final report. Van Voris, P.; Ligotke, M.W.; McFadden, K.M.; Li, S.M.W.; Thomas, B.L.; Cataldo, D.A.; Garland, T.R.; Fredrickson, J.K.; Bean, R.M.; Carlile, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 200p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88002446/JAW.

An evaluation of the terrestrial transport, transformations and ecological effects of phosphorus [red phosphorus-butyl rubber (RP/BR)] smoke obscurant was performed at Pacific Northwest Laboratory. A similar evaluation using white phosphorus (WP) smoke/obscurant is currently proceeding. The objective is to characterize the effects of smokes and obscurants on: (1) natural vegetation characteristic of US Army training sites in the United States; (2) physical and chemical properties of representative of soils of those sites; and (3) soil microbiological communities. The influence and interactions of smoke/obscurant concentration, relative humidity (25%, 60%, 90% and simulated rain) and wind speed of 0.22 to 4.45 m/s by smoke is assessed. Five plant species and four soils were exposed to both single and repeated doses of RP/BR smokes in the Pacific Northwest Laboratory "P-3" rated recirculating environmental wind tunnel. Detailed results for RP/BR and limited results for WP are presented. Toxicity symptoms for plants exposed for 2, 4, 6, and 8 hours to concentrations of RP/BR ranging from 200 mg/m^3 included leaf tip burn, leaf curl, leaf abscission and drop, floral abortion, chlorosis, neucrotic spotting, wilting, desiccation and dieback. Grass and bushbean were the most sensitive. The intensity and duration of these effects varied. Soils effects data suggest that there is an increase in the mobility of selected trace elements after exposure; however, this effect appears to be ameliorated with time. Soil microbial community effects show a reduction in

the production of nitrate after soil is exposed to RP/BR smoke. Most of the plant, soil and soil microbial effects are transient in nature and are somewhat less intense resulting from repeated exposures; however, there is evidence that some of these environmental impacts may be persistent. 43 refs., 44 figs., 67 tabs.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 10909, 10950, 10951, 10952, 10953, 10954, 10956, 10958, 10959, 10960, 10961, 10962, 10964, 10967, 10968, 10971, 10973, 10974, 10975, 10976, 10977, 10978, 10979, 10980, 10981, 10987, 11000, 11001, 11003, 11004, 11005, 11006, 11012, 11014, 11015, 11016, 11017, 11018, 11019, 11020, 11021, 11022, 11024, 11026, 11028, 11029, 11030, 11031, 11032, 11033, 11035, 11038, 11039, 11040, 11042, 11043, 11053, 11503, 11504, 12044, 12491, 12492, 12497, 12525, 12574, 12660, 12740

12514 **(CONF-871075—26) Allowable residual contamination levels of radionuclides in soil from pathway analysis.** Nyquist, J.E.; Baes, C.F. III. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001762/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The uncertainty regarding radionuclide distributions among Remedial Action Program (RAP) sites and long-term decommissioning and closure options for these sites requires a flexible approach capable of handling different levels of contamination, dose limits, and closure scenarios. We identified a commercially available pathway analysis model, DECOM, which had been used previously in support of remedial activities involving contaminated soil at the Savannah River Plant. The DECOM computer code, which estimates concentrations of radionuclides uniformly distributed in soil that correspond to an annual effective dose equivalent, is written in BASIC and runs on an IBM PC or compatible microcomputer. We obtained the latest version of DECOM and modified it to make it more user friendly and applicable to the Oak Ridge National Laboratory (ORNL) RAP. Some modifications involved changes in default parameters or changes in models based on approaches used by the EPA in regulating remedial actions for hazardous substances. We created a version of DECOM as a LOTUS spreadsheet, using the same models as the BASIC version of DECOM. We discuss the specific modeling approaches taken, the regulatory framework that guided our efforts, the strengths and limitations of each approach, and areas for improvement. We also demonstrate how the LOTUS version of DECOM can be applied to specific problems that may be encountered during ORNL RAP activities. 18 refs., 2 figs., 3 tabs.

12515 **(EGG—10282-1118) An aerial radiological survey of Areas 16 and 30, Nevada Test Site: Date of survey: June 1983.** Bluitt, C.M. (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Oct 1986. Contract AC08-83NV10282. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003244/JAW.

An aerial radiological survey of the Nevada Test Site (NTS) was conducted for the US Department of Energy (DOE). The survey period was from 1 June to 16 June 1983, during which airborne measurements were obtained over Areas 16 and 30. The data were used to generate exposure rate, cobalt-60, and cesium-137 spatial distribution maps. The aerial survey results are expressed as exposure rate, cesium-137, and cobalt-60 isopleth contours, superimposed on NTS maps. 12 refs., 16 figs.

12516 **(FMPC/Sub—008-Vol.3) Characterization Investigation Study: Volume 3, Radiological survey of surface soils.** Solow, A.J.; Phoenix, D.R. (Weston (Roy F.), Inc., West Chester, PA (USA)). Dec 1987. Contract AC05-86OR21600. 372p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE88004512/JAW.

The Feed Materials Production Center was constructed to produce high purity uranium metal for use at various Department of Energy facilities. The waste products from these operations include general uncontaminated scrap and refuse, contaminated and uncontaminated metal scrap, waste oils, low-level radioactive waste, co-contaminated wastes, mixed waste, toxic waste, sludges from water treatment, and fly ash from the steam plant. This material is estimated to total more than 350,000 cubic meters. Other wastes stored in this area include laboratory chemicals and other combustible materials in the burn pit; fine waste stream sediments in the clear well; fly ash and waste oils in the two fly ash areas; lime-alum sludges and boiler plant blowdown in the lime sludge ponds; and nonradioactive sanitary waste, construction rubble, and asbestos in the sanitary landfill. A systematic survey of the surface soils throughout the Waste Storage Area, associated on-site drainages, and the fly ash piles was conducted using a Field Instrument for Detecting Low-Energy Radiation (FIDLER). Uranium is the most prevalent radioactive element in surface soil; U-238 is the principal radionuclide, ranging from 2.2 to 1790 pCi/g in the general Waste Storage Area. The maximum values for the next highest activity concentrations in the same area were 972 pCi/g for Th-230 and 298 pCi/g for U-234. Elevated activity concentrations of Th-230 were found along the K-65 slurry line, the maximum at 3010 pCi/g. U-238 had the highest value of 761 pCi/g in the drainage just south of pit no. 5. The upper fly ash area had the highest radionuclide activity concentrations in the surface soils with the maximum values for U-238 at 8600 pCi/g, U-235 at 2190 pCi/g, U-234 at 11,400 pCi/g, Tc-99 at 594 pCi/g, Ra-226 at 279 pCi/g, and Th-230 at 164 pCi/g.

12517 **(FS—87-43-AKU) Strontium measurement results from the Federal Republic of Germany and from Switzerland after the Chernobyl reactor accident. Data compilation of the 'Working Group Environmental Monitoring'.** Neu, A.; Goll, L.; Voelkle, H.; Winter, M. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (Germany, F.R.). Arbeitskreis Umweltueberwachung; Landesanstalt fuer Umweltschutz Baden-Wuerttemberg, Karlsruhe (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Oct 1987. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751270/JAW.

The Working Group Environmental Monitoring (AKU) of Fachverband fuer Strahlenschutz e.V. (Radiation Protection Association) performed an inquiry about the time after the Chernobyl reactor accident concerning the results of strontium-90 measurements carried out for the territories of the Federal Republic of Germany and Switzerland. The data suppliers listed in the report furnished to AKU results of Sr-90 measurements made on approximately 1000 samples in total. The individual measuring results have been entered into separate tables in a uniform representation. The tables also include the results of Sr-89-measurements as well as the Cs-137/Sr-90 ratios as far as they were available. The results of measurements presented here taken together prove that contamination with Sr-90 of the environmental media including food as a result of the Chernobyl fallout were only low in the Federal Republic of Germany and in Switzerland compared with the contamination due to the nuclides I-/131 and Cs-137. The same applies to the amount of Sr-90 transferred into the soil as compared with the level of existing contamination due to nuclear weapons fallout which has accumulated since the 60ies.

12518 **(IPEN-Pub—112, pp 89) Criteria and evaluation of shallow land burial sites.** Chandra, U. Jul 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88780012/JAW. (CONF-861065—).

From Seminar on management options for low and intermediate level wastes in Latin America; Rio de Janeiro, Brazil (13 Oct 1986).

The criteria for shallow ground disposal of radioactive wastes as developed by Nuclear Regulatory Comission-US and International Atomic Energy Agency are discussed. Emphasis has been given to: elaboration of various basic components of a national strategy for radioactive waste disposal; development of technical requirements; environmental standards, consensus among scientific community and public confidence. Aspects of site selection, evaluation/characterization and site suitability are dealt with. Some results of characterization of a site for temporary storage of low level solid radioactive wastes in Instituto de Pesquisas Energeticas e Nucleares - IPEN - CNEN/Sao Paulo are described. The methods used for hydrological characterization include use of artificial tritium for unsaturated zone and radioactive tracers like I - 131, $Cr^{51}Cl_3$, $Cr^{51}EDTA$, Br^{82} for the saturated zone.

12519 (LA—11134-MS) Background concentrations of radionuclides in soils and river sediments in northern New Mexico, 1974-1986. Purtymun, W.D.; Peters, R.J.; Buhl, T.E.; Maes, M.N.; Brown, F.H. (Los Alamos National Lab., NM (USA)). Nov 1987. Contract W-7405-ENG-36. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001560/JAW.

This report documents the range and the upper limit for background concentrations of radionuclides and radioactivity in soils and river sediments that occur as natural rock-forming minerals and worldwide fallout from atmospheric nuclear weapons tests. Documentation is based on the collection of soil and sediment in northern New Mexico and analyzed for ^{137}Cs, ^{238}Pu, /sup 239,240/ Pu, ^{90}Sr, total uranium, gross gamma, and tritium. The data used to establish the statistical range and upper limit of background concentration cover a 9- or 13-year period ending in 1986. The knowledge of background levels is necessary to interpret soil and sediment data collected for the annual environmental surveillance report and other reports relating to radionuclides or radioactivity in soils and sediments. 11 refs., 1 fig., 5 tabs.

12520 (ORNL/TM—10312) Radiological survey at the Naval Explosive Ordnance Disposal Technology Center, Indian Head, Maryland. Cottrell, W.D.; Carrier, R.F. (Oak Ridge National Lab., TN (USA)). Sep 1987. Contract AC05-84OR21400. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003687/JAW.

A radiological survey of Buildings 2083 and 2084 was performed. The survey included: gamma scanning of all accessible areas; sampling of surface soil and gravel; sampling of subsurface soil from auger holes; gamma logging of auger holes; sampling of drain outfall and sewer sediments; and measuring of alpha and beta-gamma activity on wall, structural, and overhead surfaces. Radioactive contamination attributable to ^{232}Th and ^{238}U residuals was found in Bays 1, 3, 5, 51, 55, and 57 of Building 2083 and Bays 44, 50, and 56 of Building 2084. Remediation was conducted in several areas subsequent to identification of localized contamination associated with scrap or visible residues. Gamma exposure rates throughout the site following cleanup were 5 to 130 μR/h with contamination remaining in Bays 1, 3, 51, 55, and 57. The maximum concentration of ^{238}U, 3800 pCi/g, occurred in surface soil collected from Bay 55. This value exceeds the average background value for the Charles County area by a factor of ~4100. The maximum concentration of ^{232}Th, 95 pCi/g, was found in a surface soil sample from Bay 1. This concentration exceeded the DOE guideline of 5 pCi/g by a factor of ~18. Analysis of drain outfall and sewer sediment samples revealed no evidence of the migration of significant levels of radionuclides. Structural surfaces were found to have no significant contamination by alpha and beta-gamma emitters. 1 ref., 12 figs., 10 tabs.

12521 (PNL-SA—15256) On the design of a sampling plan to verify compliance with EPA standards for radium-226 in soil at uranium mill tailings remedial action sites. Gilbert, R.O.; Miller, M.L.; Meyer, H.R. (Pacific Northwest Lab., Richland, WA (USA); Weston (Roy F.), Inc., Albuquerque, NM (USA); Chem-Nuclear Systems, Inc., Albuquerque, NM (USA)). Sep 1987. Contract AC06-76RL01830. 35p. (CONF-8710245—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003426/JAW.

From ASA/EPA conference on compliance sampling; Washington, DC, USA (5 Oct 1987).

This paper discusses design aspects of a two-stage compliance sampling program being developed to verify that removal of soil at windblown uranium mill-tailings sites are results in ^{226}Ra concentrations that meet Environmental Protection Agency (EPA) standards. In the first stage, gamma scans of surface soil would be conducted over the entire remediated region using a tractor-mounted gamma-ray counting system (RTRAK) to measure ^{214}Bi (Bismuth), which is an indicator of ^{226}Ra in soil. In the second stage, composite soil samples would be collected from a systematic sample of 10-m by 10-m plots, where the number of plots is determined using a compliance acceptance sampling plan. These soil samples are analyzed for ^{226}Ra and compared with the EPA standard of 5 pCi/g above background using a selected statistical rule.

12522 (STUK-A—59) Radioactivity of vegetables and mushrooms in Finland after the Chernobyl accident in 1986. Supplement 4 to annual report STUK-A55. Rantavaara, A. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 88p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751317/JAW.

The Finnish Centre for Radiation and Nuclear Safety determined gamma-emitting radionuclides in vegetables, fruit and mushrooms in the growing season of 1986. About 780 samples of the most common species were collected during six months in locations which represent different fallout areas of radioactivity. The samples were analysed for the gamma-emitting substances by semiconductor-spectrometry. /sup 89/Sr and /sup 90/Sr were determined radiochemically in a limited number of vegetable and berry samples. Early in May 1986, /sup 131/I and other short-lived radionuclides were dominating. Later in the sampling season, the most important substances detected were /sup 134/Cs and /sup 137/Cs. The lowest concentrations of /sup 137/Cs were measured in leafy and fruit vegetables, root crops and potatoes, 0.3 - 8 Bq kg/sup -1/ on an average, depending on the species. In garden berries the nationwide mean /sup 137/Cs concentrations were 10 - 30 Bq kg/sup -1/ and in wild berries 80 - 120 Bq kg/sup -1/. The average concentrations of /sup 137/Cs in different types of mushrooms varied from 220 to 1100 Bq kg/sup -1/. The contents of /sup 90/Sr in vegetables and berries were about the same or slightly higher than in the previous years. The daily intake of /sup 137/Cs via the products studied was estimated using nationwide production-weighted mean contents of / sup 137/Cs in different species and data on the average consumption of foodstuffs. Fruit and vegetables of the season 1986 contributed 3.4 Bq d/sup -1/ to the dietary intake and mushrooms about 1 Bq d/sup -1/. The effects of processing on vegetables and fruits were not taken into account in the intake calculations. The dietary intake of radionuclides other than /sup 134/Cs and /sup 137/Cs via the produce of season 1986 was very small.

12523 Modelling tritium transport in the environment. Murphy, C.E. Jr. (Du Pont de Nemours, E.I. and Co., Aiken, SC, USA. Savannah River Lab.). *Radiation Protection Dosimetry;* 16: No. 1-2, 51-58(1986). (CONF-860214—).

From Workshop on environmental and human risks of tritium; Karlaruhe, F.R. Germany (17 Feb 1986).

A model of tritium transport in the environment near an atmospheric source of tritium is presented in the general context of modelling material cycling in ecosystems. The temporal and spatial scales of the model were chosen to allow a comparison with environmental monitoring data for tritium collected in the vicinity of the Savannah River Plant. Initial simulations with the model showed good agreement with the monitoring data, which included measurements of atmospheric and vegetation tritium concentrations. The model can also simulate values of tritium in organic matter in vegetation if the key parameter distributing the source of organic hydrogen is varied to fit the data. Simulations with the model have been used to estimate the effect of different values of the distribution parameter on the dose to man. The simulation suggests that the dose from tritiated hydrogen is about 4% of the dose from tritiated water vapour when direct incorporation of tritium into organic matter is not included. The relative dose can be considerably higher for cases where the distribution parameter is set to include very small amounts of organic tritium from atmospheric tritiated hydrogen.

12524 Volatilization of iodine from soils and plants. Wildung, R.E.; Cataldo, D.A.; Garland, T.R. (Pacific Northwest Lab., Richland, WA 99352). pp 243-249 of Speciation of fission and activation products in the environment. Bulman, R.A.; Cooper, J.R. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-850473—).

From Seminar on the speciation of fission and activation products in the environment; Oxford, UK (16 Apr 1985).

Elevated levels of /sup 129/I, a long-lived fission product, are presented in the environment as a result of nuclear weapons testing and fuel reprocessing. To aid in understanding the anomalous behavior of this element, relative to natural I (/sup 127/I), in the vicinity of nuclear fuel reprocessing plants, preliminary laboratory-growth chamber studies were undertaken to examine the possible formation of volatile inorganic and organic I species in soil and

plant systems. Inorganic /sup 129/I added to soil was volatilized from both the soil and plant during plant growth, at average ratios of 2 x 10/sup -3/%/day soil and 9 x 10/sup -3/%/day foliage, respectively. Volatilization rates from soil were an order of magnitude less in the absence of growing roots. Less than 2% of soil or plant volatiles was subsequently retained by plant canopies. Volatile I, chemically characterized by selective sorption methods, consisted principally of alkyl iodides formed by both soil and plant processes. However, plants and soils containing actively growing roots produced a larger fraction of volatile inorganic I than soil alone.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 10750, 10799, 10964, 10981, 11007, 11008, 11013, 12505

12525 **(NP—8751233) Investigation of the migration of harmful organic substances through mineral seals by means of radioactive tracers. Final report.** Jessberger, H.L.; Buderus, J. (Bochum Univ. (Germany, F.R.). Lehrstuhl fuer Grundbau und Bodenmechanik). Dec 1986. 160p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751233/JAW.

In the basic sealing of deposits of rubbish, the long term chemical stability of the clay minerals used and the pore cements to chemical solutions is the decisive factor for the sealing effect against groundwater. Two different mineral sealing materials were selected, a natural silt soil and a bentonite cement/sand mixture, in order to examine the effect of parameters specific to samples on the flow values of organic test liquid. The integration behaviour is observed by means of radioactive tracers, where, in order to measure the distribution of radioactivity, an auto-radiographic method and evaluation using a local resolving counter tube are used.

5106 Regulations

REFER ALSO TO CITATION(S) 10981, 12503, 12588, 12590, 12592

12526 **(CONF-871075—18) ORNL Environmental Review and Documentation Program.** Braunstein, H.M.; Rohwer, P.S. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001430/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The ORNL Environmental Review and Documentation Program (ERDP) is part of the Environmental Monitoring and Compliance Department (EMCD) in the ORNL Environmental Compliance and Health Protection (ECHP) Division. The program came into existence in response to enhanced environmental awareness and the need for environmental review of all operations and activities at ORNL, including those conducted by construction subcontractors. The role of the ERDP is to ensure ORNL's compliance with all applicable environmental permits, rules regulations, and statutes; to promote environmental protection by implementation of ORNL's Environmental ALARA policy; and to maintain a high level of environmental quality throughout all phases of ORNL activities, operations and projects.

12527 **(PB—88-106455/XAB) Superfund Record of Decision (EPA Region 3): West Virginia Ordnance Works, Mason County, West Virginia, March 1987. First remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 22 Mar 1987. 88p. (EPA/ROD/R—03-87/034). NTIS, PC A05/MF A01.

The West Virginia Ordnance Works (WVOW) site covers approximately 8,323 acres in Mason County, West Virginia. In 1942, WVOW was established as a government-owned, contractor-operated plant for the manufacture of trinitrotoluene explosives (TNT). Approximately one-third of the area is currently occupied by the McClintic Wildlife Station which is operated by the West Virginia Department of Natural Resources (DNR). Smaller portions of the nonindustrial areas of the site were declared excess and sold. They are now owned by Mason County or by private owners. TNT was produced from 1942-1945 by a batch process involving the nitration of toluene by the addition of nitric acid and sulfuric acid. Production during World War II resulted in soil contamination of the industrial area, process facilities, and industrial waste water disposal facilities by TNT, associated by products, and environmental transformation products. At the close of operations in 1945, WVOW was decontaminated by the Department of Defense and placed on standby status. Later that year, the plant was declared surplus and the facilities salvaged or disposed of.

12528 **(PB—88-106471/XAB) Superfund Record of Decision (EPA Region 4): Newport Dump Site, Wilder, Kentucky. First remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 27 Mar 1987. 88p. (EPA/ROD/R—04-87/021). NTIS, PC A05.

The Newport Dump site is located on the Licking River, a tributary of the Ohio River, in the City of Wilder, Kentucky. The site was originally purchased by the City of Newport in the late 1940's and was used by the City for the disposal of residential and commercial wastes from its opening until its closure in 1979. Trenching and area filling of the waste were the most common methods used to dispose of waste at the site. In 1968, the Commonwealth of Kentucky instituted permitting requirements for landfills. The City of Newport received a permit in late 1969 to operate the site as a municipal sanitary landfill. The site was closed in 1979 and ownership was transferred to the Northern Kentucky Port Authority (NKPA) the same year. During the life of the landfill, the City was cited on numerous occasions for operational violations and for handling hazardous waste without a permit. The contaminated media includes: ground water, and soil. The primary contaminants of concern include: metal; PAHs; solvents; and PCBs. The selected remedial action includes: implementation of a multi-media monitoring program; restoration and extension of leachate collection system; restoration, regrading, and revegetation of existing clay cap.

12529 **(PB—88-106521/XAB) Superfund Record of Decision (EPA Region 6): Petro-Chemical Systems, Liberty County, Texas, March 1987. First remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 27 Mar 1987. 39p. (EPA/ROD/R—06-87/018). NTIS, PC A03/MF A01.

The Petro-Chemical Systems site is a 296-acre tract of land located in Liberty County, Texas. It is in a sparsely populated area seven miles north of I-10 off Frontier Park Road. Waste oils were stored onsite prior to their use, in several pits on approximately four to six acres of the site. Records indicate that waste oils were spread on Frontier Park Road at the site as a method of dust control. In June 1970, all waste-oil disposal operations were discontinued and in 1974, the site's commercial disposal facility permit was withdrawn. The Texas Water Commission (TWC) and EPA conducted preliminary investigations of the site in 1982 and 1984. Elevated concentrations of polyaromatic hydrocarbons (PAHs) were found in the former disposal pits. At the end of 1984, the site was placed on the NPL. The primary contaminants of concern include: VOCs, PAHs, benzene and napthalene. Benzene contamination was found up to a maximum concentration of 2100 ppm and napthalene up to a maximum concentration of 700 ppm. Contaminated media includes soil along Frontier Park Road.

12530 **(PB—88-106539/XAB) Superfund Record of Decision (EPA Region 6): Bayou Bonfouca, Slidell, Louisiana, March 1987. Second remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 31 Mar 1987. 73p. (EPA/ROD/R—06-87/019). NTIS, PC A04/MF A01.

See also PB—85-249472.

The Bayou Bonfouca site is an abandoned creosote works facility that was operational from 1892 to 1970. It is located north of Lake Pontchartrain in Slidell, Louisiana in a 100-year flood plain, and is characterized by standing water and saturated surface soil. The creosote plant treated pilings for use in railway construction. Over the years, the plant operated under the ownership of various creosote companies. Present property ownership is with the Braseman Corporation. Numerous creosote releases occurred during the years of operation. Since 1976, numerous studies were done to examine the extent of the problems orginating from the Bayou site

and in December 1982, the site was placed on the NPL. The primary contaminants of concern are polynuclear aromatic hydrocarbons (PAHs) including: benzo(a) pyrene, benzo(a)anthracene, benzo(b)flouranthene, benzo(k)fluoranthene, indeno(1,2,3,-cd) yrene, and chrysene. In August 1985, excavation and offsite landfilling on creosote waste piles was addressed in a source control operable unit ROD. The determination of the extent of soil contamination was the focus of this second operable unit.

12531 **(PB—88-113477/XAB) Compendium of costs of remedial technologies at hazardous-waste sites. Final report, January 1985-September 1986.** Yang, E.C.; Bauma, D.; Schwartz, L.; Werner, J.D. (Trans World Airlines, Inc., Kansas City, MO (USA)). Oct 1987. 206p. NTIS, PC A10/MF A01.

Accurate estimates of hazardous-waste-site remedial responses are important in order to: (1) budget the Superfund Response Fund; (2) estimate costs at specific sites; (3) cost-effectively select remedial actions; and, (4) effectively negotiate with private response parties for private action or cost recovery. The costs documented here are the bottomline numbers showing the ultimate cost of the responses. The data supporting this compendium is derived from a series of 31 case studies of actual hazardous waste remedial responses. The report also investigates the divergence between actual remedial costs and estimates from existing engineering cost methodologies.

12532 **(PB—88-118013/XAB) Guam coastal management program and final environmental impact statement. Volume 1.** (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Coastal Zone Management). Jul 1979. 274p. (OCRM—87-14). NTIS, PC A12/MF A01.

See also Volume 2, PB—88-118021.

Contents include: The Federal Coastal Zone Management Act; Summary of Guam's coastal management program; How the Guam coastal management program meets the requirements of the Coastal Zone Management Act; Description of the proposed action - the Guam coastal management program; Description of the environment affected; Probable impacts of the proposed action; The relationship of the proposed action to land-use plans, policies and controls of the area; Alternatives to the proposed action; Probable adverse environmental effects which cannot be avoided; relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; Irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

12533 **(PB—88-118021/XAB) Guam coastal management program and draft environmental impact statement. Volume 2.** (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Coastal Zone Management). Jul 1979. 184p. (OCRM—87-15). NTIS, PC A09/MF A01.

See also Volume 1, PB—88-118013; Portions of this document are not fully legible.

Contents include: legal authorities; summary tables, CZM land-use opinion survey; national and Guam registers of historic places; lists of endangered and threatened plant and animal species on Guam; relationship of agencies under current programs; Guam Environmental Protection Agency programs and responsibilities; background materials.

12534 **(PB—88-120811/XAB) State of Connecticut coastal management program and final environmental impact statement.** (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Coastal Zone Management). 1980. 543p. (OCRM—87-13). NTIS, PC A23/MF A01.

The State of Connecticut has submitted its Coastal Management Program to the Office of Coastal Zone Management for approval. Approval would allow program administrative grants to be awarded to the state, and require that federal actions be consistent with the program. The document includes a copy of the program which is a comprehensive management program for coastal land- and water-use activities. It consists of numerous policies on diverse management issues enforced by various state laws, and is the culmination of several years of program development.

12535 **(PB—88-122783/XAB) State of South Carolina coastal management program and final environmental impact statement, 1979.** (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Coastal Zone Management). 1980. 418p. (OCRM—87-18). NTIS, PC A18/MF A01.

Contents include: The Federal Coastal Zone Management Act; Summary of the South Carolina coastal program; How the South Carolina coastal program meets the requirements of the Coastal Zone Management Act; Description of the proposed action; (The South Carolina Coastal Program Note: A Table of Contents for the Program is included in the front of Part II); Environmental impact statement: Description of the environment affected, Probable impacts of the proposed action on the environment, Alternatives to the proposed action, Probable adverse environmental effects that cannot be avoided, Relationship between local, short-term uses of the environment and the maintenance and enhancement of long-term productivity, Irrevocable or irretrievable commitments of resources that would be involved in the proposed action, and Relationship of proposed action to land- and water-use plans, policies, and controls in the area.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 10807

12536 **(GKSS—87/E/26) Adsorption of hexachlorobenzene on naturally occuring adsorbents in water.** Wilken, R.D.; Wirth, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1987. 7p. (CONF-8506381—). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.).

From International symposium on hexachlorobenzene; Lyon, France (24 Jun 1985).

To evaluate the distribution of hexachlorobenzene (HCB) between water and natural adsorbents, laboratory experiments were performed with /sup 14/C-labelled HCB, with quartz, kaolinite, illite, bentonite, peat, suspended particulate matter and activated sewage sludge as the natural adsorbents. HCB was bound mainly to organogenic adsorbents with distribution coefficients between 140 (for bentonite) and 28000 (for activated sewage sludge). Desorption experiments showed that distilled water could remobilize up to 100% HCB from mineral adsorbents, but only 3% from activated sewage sludge. Using these values, basic parameters for the bioavailability of HCB in natural waters were estimated.

12537 **(N—88-10468) Effect of wind and currents on gas exchange in an estuarine system. Final technical report, 1 August 1986-31 July 1987.** Broecker, W.S.; Ledwell, J.R.; Bopp, R. (Columbia Univ., New York (USA)). Nov 1987. 11p. (NASA-CR—181424; NAS—1.26:181424). NTIS, PC A03/MF A01.

The objectives were to develop a non-volatile tracer to use in gas exchange experiments in laterally unconfined systems and to study applications of deliberate tracers in limnology and oceanography. Progress was made on both fronts but work on the development of the non-volatile tracer proved to be more difficult and labor intensive that anticipated so no field experiments using non-volatile tracers was performed as yet. In the search for a suitable non-volatile tracer for an ocean scale gas exchange experiment a tracer was discovered which does not have the required sensitivity for a large scale experiment, but is very easy to analyze and will be well suited for smaller experiments such as gas exchange determinations on rivers and streams. Sulfur hexafluoride, SF_6, was used successfully as a volatile tracer along with tritium as a non-volatile tracer to study gas exchange rates from a primary stream. This is the first gas exchange experiment in which gas exchange rates were determined on a head water stream where significant groundwater input occurs along the reach. In conjunction with SF_6, Radon-222 measurements were performed on the groundwater and in the stream. The feasibility of using a combination of SF_6 and radon is

being studied to determine groundwater inputs and gas exchange of rates in streams with significant groundwater input without using a non-volatile tracer.

12538 **(PB—88-120688/XAB) Bowhead whale, balaena mysticetus bibliography. Final report.** Setzler-Hamilton, E.M.; Oliver, G.W. (Maryland Univ., Princess Anne (USA). Coastal Ecology Research Lab.). Jan 1987. 345p. NTIS, PC A15/MF A01.

This report categorizes the research literature on bowhead whales according to major research topics, issues of concern to Outer Continental Shelf oil and gas development, and geographic areas. The report has an extensive cross index.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10712, 10797, 10798, 10800, 10801, 10804, 10811, 10986, 11734, 11735, 12442, 12459, 12482, 12484, 12501, 12510, 12511, 12512, 12578, 12579, 12580, 12581, 12586, 12641, 12741, 12744, 12747, 12751, 12753, 12754, 12756, 12781, 12782

12539 **(AD-A—184842/3/XAB) Installation restoration program. Phase 2. Confirmation/quantification. Stage 1. Volume 1. Pease Air Force Base, New Hampshire. Final report.** Kraybill, R.L.; Smart, G.R.; Dunn, A.L.; O'Neill, G.T. (Weston (Roy F.), Inc., West Chester, PA (USA)). Aug 1987. 312p. NTIS, PC A14/MF A01.

See also Appendices AD-A184 843.

Information regarding potential or actual impacts of 20 sites on area ground water and surface water was obtained. Analyses included the screening parameters TOX, TOC, Oil & Grease, phenols, cyanide, and selected priority-pollutant organics and metals at certain sites. Although the screening parameters of TOX, TOC, and O&G did not provide compound-specific information, they were useful in categorizing sites which had been suspect spill or disposal sites for fuels or solvents. Where compound-specific data were collected, no priority pollutant volatile organic compounds which exceeded a State or Federal Maximum Contaminant Level (MCL) were found in the newly installed monitoring wells or surface water sampling locations. A base production well has shown contamination in excess of the proposed MCL for trichloroethylene. In addition, phenols and selected metals were found to exceed MCLs at localized groundwater or surface water sampling locations. Overall base water quality was concluded to be generally good with respect to State and Federal Standards. Two sites were recommended for expedited remedial acions involving former storage tanks and buried drum removal.

12540 **(AD-A—184843/1/XAB) Installation-restoration program. Phase 2. Confirmation/quantification. Stage 1 for Pease Air Force Base, New Hampshire. Volume 2. Appendices. Final report, October 1984-July 1986.** Kraybill, R.L.; Smart, G.R.; Dunn, A.L.; O'Neill, G.T. (Weston (Roy F.), Inc., West Chester, PA (USA)). Aug 1987. 860p. NTIS, PC A99/MF E04.

See also Volume 1, AD-A184 842; Availability: Document partially illegible.

Partial contents include: Well Construction Summaries, Boring Logs, and Hydraulic Conductivity Test Results; Field Raw Data; Sampling and Quality Assurance Plan; Analytical Methods and Required Detection Limits; Laboratory Analytical Reports; Federal and State Water Quality and Human Health Standards Applicable in the State of New Hampshire; Site Safety Plan.

12541 **(AD-A—184867/0/XAB) Development of sediment-quality values for Puget Sound. Volume 1. Final report.** (Tetra Tech, Inc., Bellevue, WA (USA)). Sep 1986. 546p. (TC—3090-02-VOL-1). NTIS, PC A23/MF A01.

Recent studies have indicated that sediment contamination may be linked to adverse impacts in marine biota, and that consumption of marine organisms exposed to contaminated sediments may pose risks to human health. The goals of the sediment-quality values study were to evaluate options for sediment management and to identify numerical values for concentrations of chemicals in sediments that appear to be associated with adverse biological effects in Puget Sound. It should also be noted that the sediment quality values presented in the report have been developed using Puget Sound data only. The attached report contains an evaluation of approaches and ranges of chemical values that can be applied in sediment management, but does not identify the specific values that the agencies should adopt for regulation or how these numerical values should be modified for application in specific regulatory programs. It is anticipated that the agencies involved in PSDDA will adopt sediment quality values for use in regulating the disposal of dredged material. PSEP anticipates using quality values as a tool in classifying and prioritizing areas for source control and remedial action, and in establishing discharge limits that can more effectively protect the quality of marine sediment.

12542 **(FIME—8503) Biofouling considerations in the development of Atlantic Canada's offshore petroleum industry.** Frantsi, C.; Coates-Markle, L.; Whalen, K.A.; Bacon, G.B.; Picken, G.B. (New Brunswick Research and Productivity Council, Fredericton (Canada); Aberdeen Univ. Marine Studies Ltd. (UK)). Mar 1985. 72p. (MICROLOG—85-6074). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

An exhaustive study was undertaken to assemble and analyze available information on the nature and impacts of marine macrofouling, microfouling, and biocorrosion on Atlantic Canada's offshore hydrocarbon exploitation industry. The analysis of the data indicates that Canadian government and industry efforts in this regard fall far short of the needs. Programs in place in the North Sea petroleum industry include ongoing monitoring and predictions of potential impacts to be expected from fouling communities on offshore structures. It is concluded that for the safe and successful exploitation of Atlantic Canada's offshore petroleum resources, a similar program will have to be developed. Recommendations are provided concerning the development of a distinctly Canadian program, taking into account the differences in physical and biological characteristics of the Northwest Atlantic. 5 tabs.

12543 **(GKSS—87/E/27) High resolution three-dimensional model system for baroclinic estuarine dynamics and passive pollutant dispersion.** Krohn, J.; Duwe, K.; Pfeiffer, K.D. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1987. 18p. Reprint from Nihoul, J.C.J.; Jamart, B.M. (eds.): Three-dimensional models of marine and estuarine dynamics, Elsevier, Amsterdam (Netherlands), 1987, p. 555-572.

In its lower part the Elbe estuary is characterized by a significant influence of baroclinicity connected with fresh water discharge and strong small scale variations of bottom topography, in the upper part pure fresh water conditions prevail. The system of models therefore consists of high resolution baroclinic and barotropic versions, a basic version of 250 m resolution covering the total estuary and finer segments (50-100 m resolution) being applied to areas of specific interest. The shallow water equations are formulated semi-implicitly to yield a suitable discretization of the space and time domain; the drying of tidal flats is handled without giving rise to shockwave-like disturbance in the velocity field. The model has been extended to treat the transport of passive tracers by applying a 'Monte-Carlo'-technique. The transformation into the Lagrangian formulation uses linear interpolation and some modifications taking into account the high variability of the flow field and the complex morphology. Two areas have been chosen - the brackish water zone and the fresh water zone just seaward of Hamburg - to simulate the dispersion of a number of released passive tracers under tidal influence. Results are obtained for release near the surface and release evenly distributed over the water depth. The calculated particle paths and particle distributions generally show a large variability, depending on the location and the tidal phase of insertion.

12544 **(N—88-10430) Spatial characterization of acid rain stress in Canadian Shield Lakes. Progress report, 1 February-1 August 1987.** Tanis, F.J. (Environmental Research Inst. of Michigan, Ann Arbor (USA)). 1987. 20p. (NASA-CR—181136; NAS—1.26:181136; REPT—189400-25-L). NTIS, PC A03/MF A01.

An analysis was performed to interpret the spatial aspects of lake acidification. Three types of relationships were investigated based upon the August to May seasonal scene pairing. In the first type of analysis ANOVA was used to examine the mean Thematic Mapper band one count by ecophysical strata. The primary difference in the two ecophysical strata is the soil type and depth over the underlying bedrock. Examination of the August to May difference values for TM band one produced similar results. Group A and B strata were the same as above. The third type of analysis examined the relationship between values of the August to May difference from polygons which have similar ecophysical properties with the exception of sulfate deposition. For this case lakes were selected from units with sandy soils over granitic rock types and the sulfate deposition was 1.5 or 2.5 g/sq m/yr.

12545 **(N—88-10431) Spatial characterization of acid rain stress in Canadian Shield Lakes. Progress report, 1 August 1986-1 February 1987.** Tanis, F.J. (Environmental Research Inst. of Michigan, Ann Arbor (USA)). 1987. 14p. (NASA-CR—180577; NAS—1.26:180577; REPT—189400-24-L). NTIS, PC A03/MF A01.

The acidification of lake waters from airborne pollution is of continental proportions both in North America and Europe. A major concern of the acid rain problem is the cumulative ecosystem damage to lakes and forest. The number of lakes affected in northeastern U.S. and on the Canadian Shield is though to be enormous. How seasonal changes in lake transparency are related to annual acidic load was examined. The relationship between variations in lake acidification and ecophysical units was also examined. The utility of Thematic Mapper based observations to measure seasonal changes in the optical transparency in acid lakes was investigated. The potential for this optical response is related to a number of local ecophysical factors with bedrock geology being, perhaps, the most important. Other factors include sulfate deposition, vegetative cover, and terrain drainage/relief. The area of southern Ontario contains a wide variety of geologies from the most acid rain sensitive granite quartzite types to the least sensitive limestone dolomite sediments. Annual sulfate deposition ranges from 1.0 to 4.0 grams/sq m.

12546 **(N—88-10438) Balloon-based infrared solar occultation measurements of stratospheric O_3, H_2O, HNO_3 and CF_2Cl(sub 2).** Weinreb, M.P.; Chang, I.L. (National Oceanic and Atmospheric Administration, Washington, DC (USA)). Sep 1987. 34p. (NOAA-TR-NESDIS—34). NTIS, PC A03/MF A01.

In July 1985 an infrared solar occultation experiment was performed with a balloon-borne, non-scanning, multi-detector grating spectrometer. From the data were retrieved simultaneous mixing ratio profiles of ozone, water vapor, nitric acid, and CFC-12 between 12 and 35 km. The retrieved ozone and water vapor profiles were compared with concurrent in-situ measurements with electrochemical concentration cells (ECCs) and frost-point hygrometers, respectively. The retrieved ozone profile was in good agreement with the correlative data. The retrieved values of water vapor mixing ratio, while close in magnitude to the correlative measurements, differed in their altitude dependence. Although there was no concurrent in-situ data for nitric acid and CFC-12, the retrieved profiles were consistent with measurements in the literature.

12547 **(PB—88-103155/XAB) EPA (Environmental Protection Agency) computer models are available to all.** Barnwell, T.O.; Vandergrift, S.B.; Ambrose, R.B. (Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab.). 1987. 6p. (EPA—600/M-87/025). NTIS, PC A02/MF A01.

Pub. in Water Quality International, Vol. 2, 19-21(Jun 1987); Supersedes PB—87-175311.

Water-quality models are used in conducting evaluations of waste loads from point and nonpoint sources and in pollutant-exposure assessments. To encourage the wider application of these techniques, the Office of Research and Development of the U.S. Environmental Protection Agency established the Center for Water Quality Modeling to provide a focal point for water quality modeling activities. The Center supports several modeling techniques and computer programs for water-quality analysis ranging from techniques appropriate for preliminary analysis to sophisticated models for detailed planning. The paper describes the models supported by the Center and presents an overview of the Center's activities, which include distribution and maintenance of computer programs, training of users, and sponsorship of a users group.

12548 **(PB—88-103635/XAB) Reaction of ozone with isolated aquatic fulvic acid.** Anderson, L.J.; Johnson, J.D.; Christman, R.F. (Environmental Protection Agency, Atlanta, GA (USA). Region IV). 1985. 8p. (EPA—600/J-85/499). NTIS, PC A02/MF A01.

Pub. in Organic Geochemistry, Vol. 8, No. 1, 65-69(1985).

Aquatic fulvic acid, isolated from a North Carolina bay lake, was reacted with ozone, an alternative oxidant in drinking-water treatment. Ozonated samples were acidified, extracted with other, dried, concentrated, and methylated samples prior to GC-MS analysis. Identified reaction products include mono-, di-, and tribasic aliphatic acids and benzene tricarboxylic acids. The products with the highest relative concentrations were succinic and malonic acid, although all products were at relatively low concentration levels. Many of the products identified in the study have also been seen among the reaction products of fulvic acid and other oxidants, such as Cl(2), ClO(2) and KMnO(4).

12549 **(PB—88-106166/XAB) Air stripping of contaminated water sources - air emissions and controls. Final report.** Vancit, M.A.; Howle, R.H.; Herndon, D.J.; Shareef, S.A. (Radian Corp., Research Triangle Park, NC (USA)). Aug 1987. 132p. NTIS, PC A07/MF A01.

Air-stripping towers are being used to remove low concentrations of organic contaminants from water. The report describes the technology and methods used to control air pollution resulting from this procedure. The cost of the controls is presented along with other positive and negative impacts of the technology.

12550 **(PB—88-106307/XAB) American advances in wastewater treatment related to toxics control and to sludge management.** Bishop, D.F.; Farrell, J.B.; Lee, K.M. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). Sep 1987. 55p. (EPA—600/D-87/251). NTIS, PC A04/MF A01.

Research emphasis by the United States Environmental Protection Agency in wastewater treatment has focused on control of toxics and sludge management. This paper describes highlights of the Environmental Protection Agency's research in these areas. The research on toxics control features studies on the treatability and fate of specific chemicals in conventional primary-secondary wastewater treatment and on toxicity reduction in treatment using bioassays as integrated toxicity monitors. The toxicity reduction approach uses both aquatic ecosystem and health effects assays. The research in sludge management describes a process for converting municipal sludges to oil using waste landfilling. The four year landfill evaluation revealed reduced landfill leachate pollutants and a more rapid onset of methane production for codisposal of sludges and solid waste compared to disposal of solid wastes only.

12551 **(PB—88-106430/XAB) Effluent toxicity-monitoring methodology evaluated for five industrial dischargers. Report for 1986-1987.** Sullivan, E.C.; Bishop, D.F.; Botts, J.A.; Braswell, J.W.; Slattery, G.H. (Engineering-Science, Inc., Fairfax, VA (USA)). Sep 1987. 53p. NTIS, PC A04/MF A01.

Industries are being faced with the possibility of meeting discharge limits for toxicity as States begin to enforce the water-quality standards prohibiting the discharge of toxic materials in toxic amounts. These effluent limitations create the need for an effective toxicity-monitoring tool. The City of Baltimore, with assistance from the U.S. EPA, is in the process of evaluating monitoring tools to characterize the toxicity of industrial contributors to the Patapsco Wastewater Treatment Plant (PWWTP). This paper presents the results of biological toxicity-reduction tests performed on five major industrial contributors to the PWWTP to evaluate the effectiveness of various monitoring tools as indicators of toxicity to the PWWTP biomass and potential toxicity pass-through. Toxicity

monitoring tests investigated were Microtox, ATP, chemical fractionation, COD removal, and specific oxygen uptake rate (SOUR).

12552 **(PB—88-107016/XAB) Expert system for mixing-zone analysis of toxic and conventional discharges.** Jirka, G.H.; Doneker, R.L. (Cornell Univ., Ithaca, NY (USA). School of Civil and Environmental Engineering). Sep 1987. 11p. NTIS, PC A03/MF A01.

Special water-quality regulations have been proposed to limit lethal acute concentrations of toxic pollutants to a spatially restricted toxic dilution zone. Predictive mathematical models are used to establish the initial dilution of a given discharge and the characteristics of its mixing zone. To assist the analyst in choosing the appropriate models, determining the limits of applicability, and establishing data needs, an expert system was been developed. The structured computer program uses knowledge and inference procedures obtained from experts. The personal-computer-operated program, called CORMIX1, is a subsystem of the Cornell Mixing-Zone Expert System. In current testing, CORMIX1 appears to be a highly flexible tool for regulatory analysis that is adaptable to the evaluation of alternatives in engineering design. The knowledge base and model logic are easily understood and thus offer an excellent learning environment.

12553 **(PB—88-107776/XAB) Mussel watch - measurements of chemical pollutants in bivalves as one indicator of coastal environmental quality.** Farrington, J.W.; Davis, A.C.; Tripp, B.W.; Phelps, D.K.; Galloway, W.B. (Woods Hole Oceanographic Institution, MA (USA)). 1987. 18p. NTIS, PC A03/MF A01.

Pub. in New Approaches to Monitoring Aquatic Ecosystems, ASTM STP 940, 125-139 1987.

The utility of the bivalve sentinel organism approach to monitoring for some chemicals of environmental concern in coastal and estuarine areas has been evaluated by regional and national programs and by smaller-scale research efforts during the past 15 years. The extent and severity of coastal contamination by chemicals such as polychlorinated biphenyls, chlorinated pesticides, trace metals, and plutonium was assessed in several bivalve sentinel organism programs. Advantages and limitations of this approach are presented and discussed briefly within the context of both national and international efforts.

12554 **(PB—88-107933/XAB) Use of biomonitoring to control toxics in the United States.** Thomas, N.A. (Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.). Sep 1987. 15p. (EPA—600/D-87/278). NTIS, PC A03/MF A01.

A biomonitoring program was developed in support of the National Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants. The program focuses on the use of laboratory toxicity tests on aquatic plants and animals to predict ecosystem impact caused by toxic pollutants. Both acute and chronic toxicity tests were developed to test effluents and ambient waters. Laboratory and biological field studies were conducted at nine sites. Single-species laboratory toxicity tests were found to be good predictors of impacts on the ecosystem when two or more species were used. Biomonitoring can be undertaken either on effluents and/or on the receiving waters. In that toxicity related to seeps, leachates, and storm sewers has often been found upstream from dischargers, it is beneficial to conduct both effluent and ambient biomonitoring.

12555 **(PB—88-111877/XAB) Planning workshop to develop recommendations for a ground-water monitoring strategy, held at Alexandria, Virginia, April 8-11, 1985.** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Mar 1985. 55p. (EPA—440/6-85/002). NTIS, PC A04/MF A01.

See also PB—88-111885.

The first part of the document describes the nature of ground-water monitoring and outlines current EPA statutes and programs related to ground-water monitoring. The second part describes a decision process for arriving at a strategy and analyzes the major policy issues to be considered in selecting a strategy.

12556 **(PB—88-111885/XAB) Ground-Water Monitoring Strategy for the US Environmental Protection Agency. Final report.** Dee, N. (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Dec 1985. 63p. (EPA—440/6-85/008). NTIS, PC A04/MF A01.

See also PB—88-111877.

The Ground-Water Monitoring Strategy provides a cross-Agency analysis of the need for and use of ground-water monitoring data. There are seven objectives: (1) characterize the nation's ground-water resources; (2) identify new contamination problems; (3) assess known problems to support regulatory development, standard setting, respond to site-specific problems; (4) assure compliance with regulations; (5) evaluate program effectiveness; (6) improve data quality; (7) develop a ground-water data management system.

12557 **(PB—88-111950/XAB) Improved protection of water resources from long-term and cumulative pollution: prevention of ground-water contamination in the United States.** Mlay, M. (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Apr 1987. 138p. (EPA—440/6-87/015). NTIS, PC A07/MF A01.

This publication is the report of the United States discussed at the May 1987 meeting of the Organization for Economic Co-operation and Development (OECD) on the subject of improved protection of water resources from long-term and cumulative pollution. Included in the document is an overview of water resources in the United States, a discussion of ground-water quality in the U.S., and an examination of governmental responsibilities for ground-water protection. Major sources of pollution are also discussed, as is their effect on ground-water quality and their trends. Groundwater protection management efforts are also discussed, including the legal, institutional, regulatory, and economic instruments used to promote protection.

12558 **(PB—88-112107/XAB) Ground-Water Protection Strategy for the Environmental Protection Agency.** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Aug 1984. 75p. (EPA—440/6-84/002). NTIS, PC A04/MF A01.

This document focuses on the issues of ground-water quality and the EPA's role in the assessment and control of the problem. Discussed in the document is the nature and extent of ground-water contamination in the United States, and the assessment of responsibilities in ground-water protection. An outline of the EPA's strategy on ground-water protection is examined, which includes the EPA support for State program development and institution building, contamination by unaddressed sources of contamination, and the adoption of ground-water protection guidelines.

12559 **(PB—88-112156/XAB) Factors contributing to differences in acid-neutralizing capacity among lakes in the western United States.** Eilers, J.M.; Landers, D.H.; Brakke, D.F.; Linthurst, R.A. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). Sep 1987. 21p. (EPA—600/D-87/309). NTIS, PC A03/MF A01.

A survey of lakes in mountainous areas of the Western United States was conducted in fall 1985 by the US Environmental Protection Agency (EPA) in cooperation with the USDA - Forest Service. Of the 719 probability sample lakes, only one was acidic; 99% of the lakes were estimated to have pH>6.0. However, acid-neutralizing capacity (ANC) was < or = 50 microeq L-1 for an estimated 16.8% of the lakes in the study area. Of the five subregions in the West, California had the highest proportion of lakes with ANC < or = 50 microeq L-1 (36.7%) and the Southern Rocky Mountains had the lowest proportion (4.6%). The lakes in the West were post-stratified into geomorphic units corresponding to major mountain ranges. Watershed factors, including watershed area, lake area, watershed area: lake area ratio, lake depth, watershed slope, percent exposed bedrock, elevation, and hydraulic residence time, were examined within six geomorphic units in order to evaluate their relationship to lake ANC. These watershed variables had poor predictive capability with respect to ANC. The results suggest that higher-resolution information for factors such as miner-

alogy and hydrology are required for prediction of lake ANC within a given geomorphic unit.

12560 (PB—88-114871/XAB) Southern California coastal-water research project biennial report, 1983-1984. Bascom, W. (Southern California Coastal Water Research Project Authority, Long Beach (USA)). 1984. 331p. NTIS, PC A15/MF A01.

Contents include: Wastes discharged (Characteristics of municipal wastewater 1982-1983); Biological studies (Sampling design and replication for benthic monitoring, Sediment and biological conditions on coastal slopes, The Newport Dory Fishery, Tumors in fish collected on the Palos Verdes Shelf); Physical and chemical studies (Predicting sediment quality around outfalls, Currents in San Gabriel Canyon, Measuring the oxygenated metabolites of chlorinated) hydrocarbons; Assigning values to assimilative capacity (The concept of assimilative capacity, Metal and organic contaminants in sediments and animals, Metal and organic detoxification/toxification in fish livers and gonads); Cadmium detoxification by scorpionfish (Summary of the cadmium detoxification experiment, The effectiveness of cadmium detoxification by scorpionfish, Biological effects of cadmium detoxification, Histopathology of cadmium-exposed scorpionfish).

12561 (PB—88-114889/XAB) Southern California coastal-water research project, 1986. (Southern California Coastal Water Research Project Authority, Long Beach (USA)). 1986. 61p. NTIS, PC A04/MF A01.

The report summarizes the monitoring data for 1984 and 1985 reported to the State of California's Regional Water Quality Control Boards by seven of the 13 municipal treatment plants that discharge into southern California coastal waters. The seven plants are operated by the municipalities and sanitation districts that provide funding for the Southern California Coastal Water Research Project (SCCWRP). The 1984 and 1985 average concentrations and mass emissions, calculated by SCCWRP environmental specialist from the monitoring data, are shown in the report.

12562 (PB—88-116785/XAB) Potential for migration of hazardous wood-treating chemicals during land-treatment operations. Final technical report. McGinnis, G.D. (Mississippi State Univ., Mississippi State (USA). Mississippi Forest Products Utilization Lab.). Jul 1987. 137p. NTIS, PC A07/MF A01.

See also report dated Jul 1986, PB—87-159448.

This project is an extension of the project undertaken jointly by the Environmental Protection Agency, Southern Pressure Treaters Association, and Mississippi Forest Products Laboratory. The overall objective of the study is to determine the amount and type of toxic chemicals that migrate into the ground water during active land-treatment operations. The hazardous waste at each site has been characterized chemically using a variety of parameters. Determination of the rates of microbiological degradation is complete. Studies on migration patterns are still in progress. The principal findings are that all the sites had bacteria that could degrade polycyclic aromatic hydrocarbons and pentachlorophenol. The relative rates varied for each constituent and depended on the soil type.

12563 (PB—88-116819/XAB) Risk assessment for the protection from and the prevention of ground-water contamination. Final report. Haimes, Y.Y.; Chankong, V. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Systems Engineering). Apr 1987. 287p. NTIS, PC A13/MF A01.

A methodological framework is presented for dealing with uncertainty associated with sources of groundwater contamination. The framework describes how risks (due to groundwater contamination and resulting from these uncertainties) can be assessed for any given prevention and/or correction management policy. The process of risk assessment, was followed. The aim in developing appropriate statistical models that would describe major sources of contamination (such as waste disposal) was not achieved due to inadequate availability of empirical data. A general framework for assessing risk of ground-water contamination was developed to guide the research, but only exploratory investigation of ideas to implement each step in the framework was possible.

12564 (STE—53/009/01/01) Sewage waste discharge to the Arctic marine environment. Final report. (Stanley Associates Engineering Ltd., Yellowknife, Northwest Territories (Canada)). 27 Feb 1987. vp. Indian and Northern Affairs Canada, Communications Branch, Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C.

The first purpose of the paper was to provide a data base to assist in the clarification of key environmental issues related to the discharge of sewage effluents to Arctic marine environments. A second important purpose was to develop a knowledge base regarding various sewage treatment options under Arctic and High Arctic conditions. The present practices, policies and regulations pertaining to sewage treatment and disposal to inland and offshore water in Canada are reviewed and summarized. The short-term and long-term environmental effects of discharging treated and untreated sewage into Arctic marine environments are reviewed, particularly areas of recreational beaches, commercial, domestic and native harvest fishing, and environmentally sensitive areas. Recommendations are made. The optimal primary and secondary treatment systems that will operate efficiently and effectively in the north on a seasonal and year round basis are identified. 8 figs., 11 tabs.

12565 (UBA-FB—86-002) Laboratory and semi-technical field experiments for characterising the most important processes influencing the sorption and mobilisation of heavy metals in sand-filter-columns. Foerstner, U.; Sellhorn, C.; Ahlf, W.; Calmano, W. (Umweltbundesamt, Berlin (Germany, F.R.); Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik). Mar 1986. 76p. (In German). Umweltbundesamt, Berlin (Germany, F.R.).

Umweltbundesamt - Texte.; no. 6/86.

Interactions of dissolved and solid metal species in groundwater are influenced by the conditions in solution (pH, redox, microbial activity, concentration of complexing substances and temperature) by the type of reaction (sorption/desorption, precipitation/dissolution, flocculation, etc.), by the kinetics of these reactions and by the composition of solid phases. With respect to the latter components, surface-active phases such as amorphous iron oxyhydrates or organic coatings play a predominant role in these groundwater systems.

12566 Puget Sound acidity levels drop after ASARCO shutdown. *Journal of the Air Pollution Control Association;* 37: No. 7, 844(Jul 1987).

The levels of acidity in Puget Sound region rainfall have decreased significantly since the shutdown of the ASARCO copper smelter in Tacoma, Washington, according to a study funded by the US Environmental Protection Agency. Results indicate that sulfate and hydrogen ion concentrations obtained from samples taken before the closure were significantly different than those collected after the shutdown. Rainwater samples collected downwind during smelter operation were also significantly different from those collected upwind. Sulfur dioxide is considered to be one of the principal contributors to acid rain. The smelter was a major source of sulfur dioxide emissions in the Puget Sound region before it shut down in March 1985.

12567 Development of an on-line mercury stream monitor. Hinton, E.R. Jr.; Rawlins, L.K.; Flanagan, E.B. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN). *Environmental Science and Technology;* 21: No. 2, 198-202(Feb 1987).

An on-line, computer-controlled monitor for mercury in streams and aqueous discharges is described. The instrument is capable of unattended, continuous operation in the 0.5-10 ppb mercury concentration range and is able to sound an alarm from a remote location to a central monitoring facility. 6 references, 5 figures, 1 table.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 10952, 10956, 10964, 10978, 10987, 11016, 11033, 11039, 11041, 11556, 12491, 12492, 12497, 12499, 12543, 12685, 12740, 12781, 12782

12568 **(CONF-8710169—1) Uncertainties associated with estimates of radium accumulation in lake sediments and biota.** Brenkert, A.L.; Gardner, R.H.; Bartell, S.M.; Hoffman, F.O. (Science Applications International Corp., Oak Ridge, TN (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001428/JAW.

From Workshop on methods for assessing the reliability of environmental transfer models predictions; Athens, Greece (5 Oct 1987).

A dynamic model of radium transfers between water, sediments and fish-flesh was developed to compare lakes that differ in their biological and physical characteristics. Results indicate that factors associated with differences in biological productivity between lakes can result in significant differences in the predictions and uncertainties of radium in various aquatic components. 5 refs., 2 figs., 2 tabs.

12569 **(DEMO—87/5E) Environmental isotopical techniques as a mean for the investigation of eventual leakages in the dam of Mornos (Greece).** Leontiadis, I.L. (National Research Centre for the Physical Sciences Democritos, Athens (Greece)). Jan 1987. 28p. NTIS (US Sales Only), PC A03/MF A01 - Library, Democritus NRCPS. Order Number TI88701264/JAW.

The isotopical composition of surface water was tried as a mean of investigation of the possible connection between the reservoir of the dam of Mornos and a spring appeared downstream the dam after the filling of its reservoir. From the respective analyses only those corresponding to the δD values of the water were found to be of some utility by supporting the conclusion that the spring under investigation could not be fed exclusively by the reservoir of the dam, nor even by a portion of as large as 60%. As a conclusion, in most cases of artificial reservoirs, used either for supply of drinking or irrigation water or for energy production, the usefulness of the environmental isotopical techniques for the investigation of eventual leakages is practically limited. In these cases radiotracing remains the most efficacious means. In the specific case of the dam of Mornos the partial feeding of the spring under investigation by the reservoir of the dam, as well as the fact that a small percentage of the water appearing on the roofs of the gallery and the tunnels of the dam is the result of leakages through definite flowpaths, has been proved.

12570 **(DEMO—87/7G) Investigation of the possible interconnection of the sinkhole of Taka Lake and various springs of the area.** Leontiadis, I.L.; Dimitroulas, Christos; Zouridakis, N.; Morfis, A.; Paraskevopoulou, P. (National Research Centre for the Physical Sciences Democritos, Athens, Greece; Institute of Geology and Mineral Exploration, Athens, Greece). (National Research Centre for the Physical Sciences Democritos, Athens (Greece)). Sep 1987. 31p. (In Greek). NTIS (US Sales Only), PC A03/MF A01 - Library, Democritus NRCPS. Order Number TI88701265/JAW.

/sup 51/Cr-EDTA has been used as tracer to investigate the possible interconnection of the sinkhole of Taka Lake (high plateau of Tripolis) and a number of springs in Arkadia and Lakonia (Peloponnese). For the same purpose analyses of the isotopic composition of the water of the same springs, as well as of that of Taka Lake have been performed. The results of this research reconfirm the contribution of the water entering the sinkhole of Taka Lake to the feeding of Astros Anavalos spring, this contribution being apparent only during the low flow period. The common origin of Loukou, Valtos, Moustos and Aghios Andreas spring water was also proved and determined. The origin of the water of Zorros spring (Lakonia) was determined as well.

12571 **(IAEA-R—2520-F) Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu. Final report for the period 15 December 1979 - 28 February 1987.** Jong Sung Ahn. (Korea Advanced Energy Research Inst., Daeduk, Republic of Korea). (International Atomic Energy Agency, Vienna (Austria)). Sep 1987. vp. NTIS (US Sales Only), PC Axx/MF A01. Order Number TI88701041/JAW.

The report provides the results and evaluations of environmental isotope analyses (O-18, H-2, H-3) undertaken in detailed field investigations carried out in the Han River Basin to study the hydrodynamics of river water and groundwater interrelationships. The conducted study, particularly near the Seoul area and the Taegu area, has enabled the delineation of the origin of groundwater in crystalline rock aquifers and limestone aquifers of the Han River Basin and evaluations as regards the groundwater flow dynamics based on environmental isotope data are given in the report. Refs, figs, tabs.

12572 **(PB—88-102900/XAB) Removal of uranium from drinking water by ion exchange and chemical clarification. Report for 1983-86.** Hanson, S.W.; Wilson, D.B.; Gunaji, N.N. (New Mexico State Univ., Las Cruces (USA). Engineering Research Center). Sep 1987. 71p. NTIS, PC A04/MF A01.

A pilot demonstration was conducted of ion-exchange and chemical-clarification equipment for removing uranium from drinking water. Four commercial-type ion-exchange columns and a prefiltering and regeneration solution system were constructed along with a pilot-scale chemical-clarification unit. The four ion-exchange columns each contained 2 cu ft. of resin. Three different ion-exchange resins were used. Resin capacity for uranium was represented by 12,000 to 20,000 bed volumes. The 1-gal/min chemical clarification unit consisted of a rapid-mix tank and precoat rotary vacuum filter. The unit was operated continuously for 3 months at pH values of 6 to 10 and ferric chloride concentrations of 15 to 40 mg/l. Greater than 99% removal of uranium was achieved when operating at 30 mg/l ferric chloride and pH 10. The diatomaceous earth precoat filter achieved complete solid-liquid separation. In addition to the pilot study, the report analyzes several currently operating water-treatment systems whose feed supplies contain uranium.

12573 **(PB—88-108063/XAB) Radiocesium and other nuclides in the Norwegian-Greenland Seas 1981-1982. Technical report.** Casso, S.A.; Livingston, H.D. (Woods Hole Oceanographic Institution, MA (USA)). Sep 1984. 103p. (WHOI—84-40). NTIS, PC A06/MF A01.

This report contains data obtained from measurements of various artificial radiotracers in seawater samples from the Norwegian-Greenland Seas and adjacent seas during 1981-82. The radionuclides measured include ^{137}Cs, ^{134}Cs, ^{90}Sr and ^{3}H. The sampling and analytical work result from the efforts of several laboratories. The data set includes a large number of measurements in surface water in the region and a substantial number of vertical profiles in the various water masses. The radiotracers in the region originate from nuclear fallout from atmospheric nuclear-weapons tests and from low-level releases of liquid waste to European coastal waters in association with the reprocessing of nuclear fuel.

12574 **(STUK-A—61) Radioactivity of fresh water fish in Finland after the Chernobyl accident in 1986. Supplement 6 to annual report STUK-A55.** Saxen, R.; Rantavaara, A. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). Jun 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751318/JAW.

The Chernobyl accident raised the deposition levels of radioactive substances in Finland. Fish were affected by radioactive substances in watersheds. Extensive study of areal and temporal changes in the radioactivity of freshwater fish was started soon after the accident. The aim of the study was to obtain new data on a situation involving fresh deposition and to estimate the importance of freshwater fish as a source of radiocesium for consumers. Attenuation was also paid to various factors affecting the radioactivity of fish. Samples were taken from about 200 lakes. In all, about 600 samples were analysed gammaspectrometrically. A few

samples were also analysed radiochemically for beta-emitting /sup 89/Sr and /sup 90/Sr. The samples contained about ten different species of fish. The highest concentrations of radiocesium in fish were found in the areas of highest radioactive deposition in Finland. In areas with the same level of /sup 137/Cs deposition, concentrations in fish depended on the size of the lake: the smaller the area of the lake in which the fish were caught the higher the concentration. Of the fish species studied, perches had the highest concentrations of radiocesium. Intake estimations were based on the average concentrations, weighted for catches, in each drainage area and in the whole country, and on the average intake of /sup 137/Cs via freshwater fish. In Finland, the average intake of /sup 137/Cs via freshwater fish in May-December 1986 was about 1200 Bq. The values obtained for different drainage basins varied from about 160 to 3400 Bq.

12575 **Tritium in the aquatic environment.** Blaylock, B.G.; Hoffman, F.O.; Frank, M.L. (Oak Ridge National Lab., TN, USA). *Radiation Protection Dosimetry;* **16**: No. 1-2, 65-71(1986). (CONF-860214—).

From Workshop on environmental and human risks of tritium; Karlsruhe, F.R. Germany (17 Feb 1986).

Most of the tritium released from nuclear facilities into the atmosphere eventually reaches the aqueous environment where it is rapidly taken up by aquatic organisms. This paper reviews the current literature on tritium in the aquatic environment. Conclusions from the review, which covered algae, aquatic plants, invertebrates, fish, and food chain studies, were that aquatic organisms incorporate tritium into their tissue free water very rapidly and reach concentrations near that of the external medium. Incorporation of tritium from triated water into the organic matter of cells is at a slower rate than incorporation into the tissue free water. If organisms consume tritiated food, incorporation of tritium into the organic matter is faster and a higher tritium concentration is reached than when the organisms are exposed to only tritiated water. Incorporation of tritium bound to molecules into the organic matter depends on the chemical form of the 'carrier' molecule. No evidence was found that biomagnification of tritium occurs at higher tropic levels. Radiation doses to large populations of humans from tritium releases will most likely be from the consumption of contaminated water rather than contaminated aquatic food products.

5204 Thermal Effluents Monitoring And Transport

12576 **(OH/R—86/290/K) Simulation studies of potential effects from Atikokan TGS on walleye eggs.** Griffiths, J.S. (Ontario Hydro Research Div., Toronto (Canada)). 17 Feb 1987. 19p. (MICROLOG—87-04879). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Computer simulations run using 1985 temperature data determined egg incubation periods, and hence the length of time that flow provisions are required, for walleye spawning at the Snow Lake outlet downstream from Atikokan TGS. Ambient temperature simulations indicated completion of hatch by May 31 for a late (May 11) spawning date. Assuming a ΔT of at least 5/sup 0/C, hatch would be complete by May 23. Simulations indicated best egg survival with a ΔT in the 3-5/sup 0/C range, but predicted temperature rises are in excess of 8.4/sup 0/C with 2-shift operation. Such temperatures may deleteriously affect egg survival, especially if spawning occurs as late as May 11. Detailed field monitoring of Snow Lake outlet temperatures, walleye spawning times, and hatch success are recommended to determine whether these potential impacts are occurring.

12577 **(OH/R—87/7/K) Displacement of larval fish by Bruce NGS 'A' discharge.** Rodgers, D.W. (Ontario Hydro Research Div., Toronto (Canada)). 9 Feb 1987. 34p. (MICROLOG—87-04880). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The potential for displacement of larval fish by the thermal discharge of Bruce Nuclear Generating Station 'A' was investigated by tracking drift tubes released near the discharge plume and sampling larval fish along the path followed by the drift tube. Drift paths were strongly influenced by changes in longshore lake currents which, in turn, were largely determined by prevailing winds. Under relatively constant winds to the north-northeast, the drift tubes were carried by the longshore current into the Bruce NGS 'A' thermal discharge plume and displaced up to 1 km offshore. Under light and variable wind conditions, the drift tubes were carried by the longshore current into the region of the thermal discharge plume but then moved relatively little and remained stationary at the edge of the plume. Alewife dominated the larval fish samples and comprised approximately 62% of the total larval fish collected. Gizzard shad, johnny darter, and trout perch were also significant species. The densities of larval fish within the thermal discharge were significantly lower than densities of larval fish in the zone of mixing of the thermal discharge plume or in the nearshore zone before the thermal discharge. The densities of fish in these latter regions were not significantly different. 1 fig., 3 tabs.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 10802, 11188, 12193, 12499, 12783

12578 **(DOE/EP/31111—1-Vol.1) Ecosystem analysis of the Calcasieu River/Lake Complex (CALECO): Volume 1, Introduction, executive summary, physicochemical parameters: Final report, Sampling dates: October 1983-August 1986.** DeRouen, L.R.; Stevenson, L.H. (eds.); Beck, J.N.; Felley, J.D.; Gaston, G.R.; Kjerfve, B.J.; Maples, R.S.; Murray, H.E.; Vecchione, M. (McNeese State Univ., Lake Charles, LA (USA)). 26 Jun 1987. Contract FG01-83EP31111. 405p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88002683/JAW.

This document reports on research undertaken in an effort to understand the basic ecology of the Calcasieu River/Lake Complex and to evaluate the effects of human activities on that ecology. Part of the work involved surveying the Calcasieu Estuary for the presence of anthropogenic substances as well as analyses of the effects of human activities on the biotic communities within the estuary. Routine sampling locations were located throughout the estuary from the salt water barrier on the Calcasieu River north of Interstate 10 to the mouth of the system at Cameron. Station designations and descriptions together with latitude and longitude are given. The impacts of land use on the estuary were investigated through seven major substudies: (1) Water Quality and Special Pollutants; (2) Chemistry; (3) Primary Producers; (4) Zooplankton; (5) Benthos; (6) Nekton; and (7) Hydrology. The findings of each substudy are presented in separate chapters (1 through 7). Volume 1 contains chapters 1 and 2. Volume 2 contains chapters 3, 4, 5, and 6. Volume 3 contains chapter 7. Volume 4 contains appendices. Each chapter was processed separately for the Energy Data Base.

12579 **(DOE/EP/31111—1-Vol.2) Ecosystem analysis of the Calcasieu River/Lake Complex (CALECO): Volume 2, Introduction, executive summary, biological parameters: Final report, Sampling dates: October 1983-August 1986.** DeRouen, L.R.; Stevenson, L.H. (eds.); Beck, J.N.; Felley, J.D.; Gaston, G.R.; Kjerfve, B.J.; Maples, R.S.; Murray, H.E.; Vecchione, M. (McNeese State Univ., Lake Charles, LA (USA)). 26 Jun 1987. Contract FG01-83EP31111. 489p. NTIS, PC A21/MF A01; 1; GPO Dep. Order Number DE88002684/JAW.

This document reports on research undertaken in an effort to understand the basic ecology of the Calcasieu River/Lake Complex and to evaluate the effects of human activities on that ecology. Part of the work involved surveying the Calcasieu Estuary for the presence of anthropogenic substances as well as analyses of the effects of human activities on the biotic communities within the estuary. Routine sampling locations were located throughout the estuary from the salt water barrier on the Calcasieu River north of Interstate 10 to the mouth of the system at Cameron. Station designations and descriptions together with latitude and longitude are given. The impacts of land use on the estuary were investigated

through seven major substudies: (1) Water Quality and Special Pollutants; (2) Chemistry; (3) Primary Producers; (4) Zooplankton; (5) Benthos; (6) Nekton; and (7) Hydrology. The findings of each substudy are presented in separate chapters (1 through 7). Volume 1 contains chapters 1 and 2. Volume 2 contains chapters 3, 4, 5, and 6. Volume 3 contains chapter 7. Volume 4 contains appendices. Each chapter is processed separately for the Energy Data Base.

12580 **(DOE/EP/31111—1-Vol.3) Ecosystem analysis of the Calcasieu River/Lake Complex (CALECO): Volume 3, Introduction, executive summary, hydrology: Final report, Sampling dates: October 1983-August 1986.** DeRouen, L.R.; Stevenson, L.H. (eds.); Beck, J.N.; Felley, J.D.; Gaston, G.R.; Kjerfve, B.J.; Maples, R.S.; Murray, H.E.; Vecchione, M. (McNeese State Univ., Lake Charles, LA (USA)). 26 Jun 1987. Contract FG01-83EP31111. 403p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88002685/JAW.

This document reports on research undertaken in an effort to understand the basic ecology of the Calcasieu River/Lake Complex and to evaluate the effects of human activities on that ecology. Part of the work involved surveying the Calcasieu Estuary for the presence of anthropogenic substances as well as analyses of the effects of human activities on the biotic communities within the estuary. Routine sampling locations were located throughout the estuary from the salt water barrier on the Calcasieu River north of Interstate 10 to the mouth of the system at Cameron. Station designations and descriptions together with latitude and longitude are given. The impacts of land use on the estuary were investigated through seven major substudies: (1) Water Quality and Special Pollutants; (2) Chemistry; (3) Primary Producers; (4) Zooplankton; (5) Benthos; (6) Nekton; and (7) Hydrology. The findings of each substudy are presented in separate chapters (1 through 7). Volume 1 contains chapters 1 and 2. Volume 2 contains chapters 3, 4, 5, and 6. Volume 3 contains chapter 7. Volume 4 contains appendices. Each chapter was processed separately for the Energy Data Base.

12581 **(DOE/EP/31111—1-Vol.4) Ecosystem analysis of the Calcasieu River/Lake Complex (CALECO): Volume 4, Appendices: Final report, Sampling dates, October 1983-August 1986.** DeRouen, L.R.; Stevenson, L.H. (eds.); Beck, J.N.; Felley, J.D.; Gaston, G.R.; Kjerfve, B.J.; Maples, R.S.; Murray, H.E.; Vecchione, M. (McNeese State Univ., Lake Charles, LA (USA)). 26 Jun 1987. Contract FG01-83EP31111. 576p. NTIS, PC A25. Order Number DE88002686/JAW.

This document reports on research undertaken in an effort to understand the basic ecology of the Calcasieu River/Lake Complex and to evaluate the effects of human activities on that ecology. Part of the work involved surveying the Calcasieu Estuary for the presence of anthropogenic substances as well as analyses of the effects of human activities on the biotic communities within the estuary. Routine sampling locations were located throughout the estuary from the salt water barrier on the Calcasieu River north of Interstate 10 to the mouth of the system at Cameron. Station designations and descriptions together with latitude and longitude are given. The impacts of land use on the estuary were investigated through seven major substudies: (1) Water Quality and Special Pollutants; (2) Chemistry; (3) Primary Producers; (4) Zooplankton; (5) Benthos; (6) Nekton; and (7) Hydrology. The findings of each substudy are presented in separate chapters (1 through 7). Volume 1 contains chapters 1 and 2. Volume 2 contains chapters 3, 4, 5, and 6. Volume 3 contains chapter 7. Volume 4 contains appendixes. Each chapter is processed separately for the Energy Data Base.

12582 **(EPS—1/PG/2) Environmental codes of practice for steam electric power generation. Siting phase.** (Environment Canada, Ottawa, Ontario. Conservation and Protection). Mar 1987. 168p. (MICROLOG—87-04671). Environmental Protection Programs Directorate, Environment Canada, 351 St. Joseph Blvd., Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This is one of a series of documents being developed for the steam electric power generation industry. This industry includes fossil-fuelled stations and nuclear-powered stations. In this document the environmental concerns associated with water, air and waste aspects of steam electric power plants are discussed, and a three-phase approach by site selection teams is suggested to minimize these concerns. Site selection criteria are presented that will minimize the detrimental environmental effects of cooling water systems, wastewaters discharged to surface waters and groundwaters, solid waste disposal sites, and atmospheric emissions. The siting criteria encompass five main components of the environment: land use, terrestrial ecology, surface water and groundwater, aquatic ecology and atmospheric environment. Siting concerns and criteria desribed are relevant for many major industrial facilities.

12583 **(PB—88-113964/XAB) Reservoir sedimentation: impact, extent, and mitigation. Technical paper.** Mahmood, K. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1987. 133p. (WORLDBANK-TP—71). NTISMF A01.

Library of Congress catalog card no. 87-23003.

The role of storage reservoirs in water resource development is described. It is pointed out that whereas the future demands will require additions, the present capacity is being continually eroded by siltation. The world picture of erosion and sediment yield from drainage basins is reviewed to show that the world average yield at ocean level is a modest 500 ppm, but large variations exist and local values can be much higher due to natural conditions. Human actions and natural events that further effect sediment yields are illustrated with case histories. Physical phenomena related to reservoir siltation are described to provide a basic understanding of the problem.

12584 **(PB—88-853676/XAB) Water-quality modeling: hydrological systems. April 1983-January 1986 (citations from the Selected Water Resources Abstracts data base). Report for April 1983-January 1986.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 213p. NTISPC N01/MF N01.

This bibliography contains citations concerning techniques and uses of hydrologic models. Models are used for hydrologic transport, catchment, storage, stream flow, aquifer management, and water quality in terms of sediment, salinity, and pollutants. Some models address the economic factors of watersheds and rivers. A few of the citations relate to data collection for model studies. (This updated bibliography contains 210 citations, none of which are new entries to the previous edition.)

12585 **(PB—88-853684/XAB) Water-quality modeling: hydrological systems. February 1986-November 1987 (citations from the Selected Water Resources Abstracts data base). Report for February 1986-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 173p. NTISPC N01/MF N01.

Supersedes PB—86-854973.

This bibliography contains citations concerning techniques and uses of hydrologic models. Models are used for hydrologic transport, catchment, storage, stream flow, aquifer management, and water quality in terms of sediment, salinity, and pollutants. Some models address the economic factors of watersheds and rivers. A few of the citations relate to data collection for model studies. (This updated bibliography contains 314 citations, all of which are new entries to the previous edition.)

12586 **(Y/TS—315) Comprehensive sampling program for the Y-12 Plant area source pollution assessment and control plan.** Kingrea, R.H.; Arniella, E.F.; Roesner, L.A.; Quasebarth, T. (Oak Ridge Y-12 Plant, TN (USA); Camp Dresser and McKee, Inc., Atlanta, GA (USA)). 15 Oct 1987. Contract AC05-84OS21400. 19p. (CONF-871075—19). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001817/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

The Y-12 Plant has begun an aggressive program for identifying and controlling nonpoint pollution discharges to East Fork Poplar Creek (EFPC). Nonpoint source discharges, also referred to as area source discharges, result when surface water or ground

water flows though contaminated surfaces resulting in the transport of pollutants to a receiving stream. This paper presents the approach undertaken by the project team to implement a comprehensive sampling program of the EFPC drainage area. The results of the comprehensive sampling program will be used to establish best management practices for the control of nonpoint sources in the EFPC drainage area. 5 refs., 2 tabs.

5206 Regulations

REFER ALSO TO CITATION(S) 12467, 12503, 12530, 12531, 12532, 12533, 12534, 12535, 12539, 12540, 12551, 12555, 12556, 12557, 12558

12587 (AD-A—185030/4/XAB) Environmental impact statement for the new San Clemente Project, Monterey County, California - Regulatory Permit Application Number 16516s09. Draft environmental impact report. (Corps of Engineers, San Francisco, CA (USA). San Francisco District). Sep 1987. 323p. NTIS, PC A14/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white. See also Appendices, AD-A185 031.

Joint State/Federal environmental impact document is concerned with a regulatory permit application by the Monterey Peninsula Water Management District under Section 404 of the Clean Water Act. The proposed project involves construction of a dam across the Carmel River for the purpose of water supply (M&I), drought protection, and restoration of the environmental quality of the river.

12588 (PB—88-101696/XAB) EPA (Environmental Protection Agency) initiates wetlands research in the Pacific Northwest. Kentula, M.E. (Northrop Services, Inc., Corvallis, OR (USA)). 1987. 4p. NTIS, PC A02/MF A01.

Pub. in Northwest Environmental Jnl., Vol. 3, 163-164(1987).

In January 1986 the U.S. Environmental Protection Agency (EPA) adopted a Wetlands Research Plan (Zedler and Kentula 1986). The plan describes the research necessary to assist the Agency in implementing its responsibilities for protecting wetlands, including Section 404 of the Clean Water Act. Three research needs were identified and an emphasis on freshwater systems was recommended. Research will be implemented to: (1) assess the water quality functions of wetlands; (2) develop methods to predict the cumulative impact(s) associated with wetland loss; and (3) improve the formulation and evaluation of wetland creation/ restoration projects required as mitigation for unavoidable impacts.

12589 (PB—88-106448/XAB) Superfund Record of Decision (EPA Region 1): Ottati and Goss/Great Lakes Container Corporation Site, Kingston, New Hampshire, January 1987. Final report. (Environmental Protection Agency, Washington, DC (USA)). 16 Jan 1987. 78p. (EPA/ROD/R—01-87/021). NTIS, PC A05/MF A01.

The Ottati and Goss/Great Lakes Container Corporation site (O&G/GLCC) is located in Kingston, New Hampshire west of Route 125. The study area for the RI/FS includes the 35-acre O&G/GLCC site, a marsh area east of Route 125 and Country Pond adjacent to the marsh area. North Brook and South Brook drain the marsh at its interface with Country Pond. From the late 1950s through 1967, Conway Barrel & Drum Company (CBD) owned the site and performed drum-reconditioning operations. The reconditioning operations included caustic rinsing of drums & disposal of the rinse water in a dry well near South Brook. As a result of State concerns regarding the proximity of the dry well to South Brook and complaints of resulting South Brook and Country Pond pollution, CBD established leaching pits in an area removed from South Brook. The State's Water Supply and Pollution Control Commission (WSPCC) reported onsite runoff and seepage from the leaching pits draining into South Brook and eventually into Country Pond. Reports included fish kills in Country Pond, dying vegetation along South Brook, and skin irritation of swimmers in Country Pond.

12590 (PB—88-106463/XAB) Superfund Record of Decision (EPA Region 4): Geiger (C and M Oil) site, Charleston County, South Carolina, June 1987. First remedial action. (Environmental Protection Agency, Washington, DC (USA)). 1 Jun 1987. 146p. (EPA/ROD/R—04-87/020). NTIS, PC A07.

The Geiger (C & M Oil) site comprising a five-acre area, is located in central Charleston County, South Carolina, appoximately ten miles west of the city of Charleston and within one mile of tidal wetlands. Approximately 40 people live within the immediate site area. In March 1969, Adams Run Services, Incorporated, was permitted to incinerate waste oil at the site. Eight unlined lagoons were constructed to hold the waste oil. In late 1971 in response to complaints from area residents, the South Carolina Pollution Control Authority (SCPCA) ordered all incineration and waste-deposition activities at the site stopped, and the owner to take action to prevent spillage, leekage, or seepage of oil from the site. The primary contaminants of concern include: arsenic, toluene, organics, PCB, and heavy metals (lead, chromium, mercury). The selected remedial alternative includes: extraction and onsite treatment of contaminated ground water with discharge to an offsite stream; excavation and onsite thermal treatment of soil to remove organic contaminants; solidification/stabilization of thermally-treated soil, if necessary, to reduce mobility of metals; backfilling of excavated areas with treated soil, followed by grading and covering with gravel.

12591 (PB—88-106489/XAB) Superfund Record of Decision (EPA Region 5): New Brighton/Arden Hills/St. Anthony, Minnesota, March 1987. Fifth remedial action. Final report. (Environmental Protection Agency, Washington, DC (USA)). 31 Mar 1987. 100p. (EPA/ROD/R—05-87/047). NTIS, PC A05.

See also PB—86-224912; Portions of this document are not fully legible.

The New Brighton/Arden Hills/St. Anthony site is located approximately two miles north of the Twin Cities of Minneapolis/St. Paul, Minnesota. The City of St. Anthony, located directly north of the Twin Cities, is one of several communities which obtain its municipal water supply from the Prairie due Chien-Jordan aquifer system. The City of St. Anthony obtains its water supply from well numbers 4 and 5 and an interconnection to the City of Roseville's water-distribution system. In June 1981, the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Health (MDH) detected VOC contamination in the Praire du Chien-Jordan aquifer system used for municipal drinking water in New Brighton. Subsequently, the City of St. Anthony has also detected VOC contamination in their three Praire du Chien-Jordan aquifer wells; well number 3, 4 and 5. Well 4 is the city's major source of water. Well 5 and the Roseville interconnection are used for summer, peak, or emergency situations. Well 3 was shut down in early 1984 due to VOC contamination. As the number of contaminated wells within the Praire due Chien-Jordan began increasing, EPA initiated several Initial Remedial Measures.

12592 (PB—88-106513/XAB) Superfund Record of Decision (EPA Region 6): Hardage/Criner, McClain County, Oklahoma, November 1986. First remedial action. Final report. (Environmental Protection Agency, Washington, DC (USA)). 14 Nov 1986. 97p. (EPA/ROD/R—06-87/017). NTIS, PC A05/MF A01.

The Hardage/Criner site is located in McClain County, Oklahoma, approximately 15 miles southwest of Norman, Oklahoma. The area is agricultural with land on all sides of the site used for grazing cattle. From September 1972 to November 1980, the site was operated by the Royal Hardage Industrial - Hazardous Wasteland and Disposal Facility and was permitted to accept all types of industrial and hazardous wastes except radioactive materials. The types of waste included: oil, recycling wastes, chlorinated solvents, styrene tars, acids, caustics, paint sludges, lead, chromium, cyanide, arsenic, pesticides, inks, PCBs, and large quantities of unknown wastes from injection wells and other facilities including what became the Brio and Bioecology Superfund sites. Originally, two pits were excavated; liquids and sludges from drums and tank trucks were discharged directly into these unlined pits. However, both pits filled to capacity. Wastes from the pits were transferred to

temporary ponds and then piled on a sludge mound. A total of 18 to 20 million gallons of waste was disposed at the site.

12593 **(PB—88-106547/XAB) Superfund Record of Decision (EPA Region 8): Rocky Mountain Arsenal off-post ri/fs site, Commerce City, Colorado, June 1987. First remedial action. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 4 Jun 1987. 122p. (EPA/ROD/R—08-87/011). NTIS, PC A06/MF A01.

The Rocky Mountain Arsenal (RMA) is a facility owned and operated by the United States Department of the Army. It was established in 1942 with the primary mission of manufacturing and assembling chemical and incendiary munitions to support the war effort. Afterwards, pesticides and herbicides were produced on-post by private leases. Many of these substances, their by-products and residues were later disposed of on-post. The RMA off-post site is located northeast of downtown Denver, Colorado, adjacent to RMA. The area is nearly completely developed with residential subdivisions, industrial facilities and gravel operations. South Adams County Water and Sanitation District (SACWSD) was created in 1953 to supply approximately 30,000 customers with well water from the alluvium and bedrock. Recent studies by EPA and SACWSD indicate that significant concentrations of organic solvents are present in the local and Regional ground water system which is the main source of drinking water for SACWSD. The operable unit addresses treatment or replacement of contaminated ground water within the RMA off-post site prior to its use as drinking water by customers of the SACWSD.

12594 **(PB—88-111919/XAB) Selected state and territory ground-water classification systems. Final report.** Myers, M.E.; Quinn, J. (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). May 1985. 113p. (EPA—440/6-85/005). NTIS, PC A06/MF A01.

The purpose of this document is to review state development of ground-water classification schemes for determining the level of protection needed to maintain designated use and quality of ground-water resources. Criteria used for the classification of aquifers varies, but includes ground-water quality, yield, vulnerability to contamination, hydrogeologic setting, and stresses put on the aquifer by the population. Several state and territory classification schemes are examined, as are related water-quality standards.

12595 **(PB—88-111927/XAB) Protecting ground water: the hidden resource. Journal reprint.** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Aug 1984. 35p. (EPA—440/6-84/001). NTIS, PC A03/MF A01.

A reprint, for the general public, of the August 1984 EPA Journal devoted to ground-water issues. The publication includes a discussion by EPA Administrator William D. Ruckelshaus on the need for ground-water protection, an outline of the EPA's ground-water protection strategy, as well as facts on ground water. It also contains articles about the coordination of ground-water policy between the Federal and State levels, and several States' views on, and efforts at, ground-water protection.

12596 **(PB—88-111992/XAB) Sole Source Aquifer designation: petitioner guidance.** Braem, L. (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Feb 1987. 55p. (EPA—440/6-87/003). NTIS, PC A04/MF A01.

The purpose of the guidance is to aid potential Sole Source Aquifer (SSA) petitioners to prepare and submit Sole Source Aquifer designation petitions to the Environmental Protection Agency. The Sole Source Aquifer program was established under the 1974 Safe Drinking Water Act, to protect principal or sole sources of drinking water for an area from contamination. The guidance presents an overview of the designation process, petition preparation, and how and where to submit petition information. Also included is general information about the Sole Source Aquifer program.

12597 **(PB—88-114152/XAB) Economic impact analysis of proposed amendments to public water supply regulations pending before the Illinois Pollution Control Board R85-14. Final report.** Blaser, W.L.; Markwood, I.S.; Wehrle, L.S.; McQuown, J.R. (Blaser, Zeni and Co., Springfield, IL (USA)). Aug 1987. 313p. NTIS, PC A14/MF A01.

The report provides an analysis of the economic impact of a rule change proposed by the Illinois Environmental Protection Agency which would allow, until January 1, 1989, the continued issuance of permits for water-main extensions to public water supplies whose finished drinking water exceeds federal and state standards for radiological quality and for fluoride due to naturally-occurring levels of these constituents in groundwater supplies. In Illinois, compliance with drinking-water standards for public water supplies is enforced through the use of restricted status. Public water supplies in violation of drinking water standards are placed on restricted status precluding new water main extensions until compliance is achieved. The economic-impact study approached an analysis of the proposed rule change through an evaluation of alternative compliance strategies and their costs; an evaluation of economic impacts of restricted status; and an analysis of the proposed rule.

12598 **(PB—88-114996/XAB) Polymer manufacturing industry - background information for proposed standards. Environmental Impact Statement (Draft).** (Pacific Environmental Services, Inc., Durham, NC (USA)). Sep 1985. 507p. NTIS, PC A22/MF A01.

Standards of performance for the control of volatile organic compound emissions from the polymer manufacturing industry are being proposed under the authority of Section 111 of the Clean Air Act. These standards would apply to new, modified, and reconstructed facilities that manufacture polypropylene, polyethylene, polystyrene, or poly(ethylene terephthalate). The document contains background information and environmental and economic impact assessments of the regulatory alternatives considered in developing the proposed standards.

12599 **(PB—88-116181/XAB) Analysis of recent environmental legislation as it affects the public water supply. Volume 2. Case study analysis. Final report.** Schwartz, H.E.; Ram, B.J.; Wineman, J.J. (Clark Univ., Worcester, MA (USA)). Oct 1987. 254p. (EPA—600/9-87/027B). NTIS, PC A12/MF A01.

See also Volume 1, PB—88-116173.

This study involves the analysis of three major environmental laws -- the Clean Water Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act -- and the regulations and programs under these acts as they effect implementation of the Safe Drinking Water Act. The purposes of the study are: (1) to determine what needs exist for coordinating current programs to more effectively protect public water supplies; (2) to identify problems related to the protection of public water supplies that are not explicity covered by the legislation; and (3) to develop recommendations for a research agenda for the Environmental Protection Agency to address these problems. The methodology developed for the study was intended to identify how the Safe Drinking Water Act related to implementation of the other legislation, what mechanisms for coordination currently exist, what mechanisms are insufficient or lacking, and what drinking water related problems are inadequately addressed.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 12413

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 10799, 10972, 11606, 12643

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 10802, 10809, 10810, 11007, 11008, 12501, 12532, 12533, 12534, 12535, 12587, 12598, 12640

12600 **(DOE/EIS—0121) Alternative cooling water systems, Savannah River Plant, Aiken, South Carolina: Final environmental impact statement.** (USDOE, Washington, DC). Oct 1987. 750p. NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE88003321/JAW.

This Environmental Impact Statement (EIS) provides environmental input into the selection and implementation of cooling water systems for thermal discharges from the K- and C-Reactors and from a coal-fired powerhouse at the Savannah River Plant. This EIS addresses the potential environmental consequences of constructing and operating once-through and recirculating cooling towers for the K- and C-Reactors; increased pumping to a raw water basin and direct discharge to the Savannah River for a coal-fired powerhouse; and no action. The potential environmental consequences assessed include effects on air and water quality, ecological systems, archaeological resources, endangered species, and wetlands. 172 refs., 27 figs., 59 tabs.

12601 **(PB—88-127063/XAB) Unfinished business: a comparative assessment of environmental problems. Appendix 2. Non-cancer Risk Work Group.** (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). Feb 1987. 60p. (EPA—230/2-87/025C). NTIS, PC A04/MF A01.

See also Appendix 1, PB—88-127055, and Appendix 3, PB—88-127071; Also available in set of 5 reports PC E99, PB—88-127030.

The report is one of four reports comparing risks currently associated with major environmental problems. A ranking methodology was devised and 31 environmental problems areas under EPA's jurisdiction were ranked according to the relative magnitude of the non-cancer health risks they pose. Chapter 2 of the report summarizes the results of the ranking of the non-cancer health risks associated with major environmental problem areas, and Chapter 3 reviews the process used to produce these rankings. Chapter 4 presents some overall observations on the project and recommendations resulting from it. The steps and issues in the ranking methodology are described in further detail in the Appendix.

12602 **(PB—88-127071/XAB) Unfinished business: a comparative assessment of environmental problems. Appendix 3. Ecological Risk Work Group.** (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). Feb 1987. 345p. (EPA—230/2-87/025D). NTIS, PC A15/MF A01.

See also Appendix 2, PB—88-127063, and Appendix 4, PB—88-127089; Also available in set of 5 reports PC E99, PB—88-127030.

The report is one of four reports comparing risks currently associated with major environmental problems. Specific environmental problems according to ecological risk were ranked and the results summarized in Part I of the report. Also contained in Part I are certain general conclusions reached on ecological risks and how EPA addresses them, together with related recommendations. Part II of the report describes in more detail the approach and methods used to develop the rankings, and Part III includes comments and observations on ecological risk and its priority in EPA and describes in more detail the difficulties in ranking ecological risks. Part IV is an appendix containing the full report of the panel of experts convened by the Cornell Ecosystems Research Center and the papers on individual problems which were used in developing the rankings.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

REFER ALSO TO CITATION(S) 12503

12603 **(DOE/OR/00033—T361) Annual report for National Foundation for Iletis and Colitis.** Clapp, N.K. (Oak Ridge Associated Universities, Inc., TN (USA)). 17 Jul 1987. Contract AC05-76OR00033. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002396/JAW.

This report describes one year's research activity at the Oak Ridge Associated Universities (ORAU) Marmoset Center. ORAU's in-house research program is included in outline form; 22 extramural collaborations are listed. The advantages of a primate model system are discussed and recent publications are listed. Most research is directed towards solving problems associated with iletis and colitis. (TEM)

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 12734, 13817

5502 Biochemistry

REFER ALSO TO CITATION(S) 11158, 11198, 11203, 11212, 11213, 12611

12604 **(INIS-mf—11069) Structural analysis of the carbohydrate chains of glycoproteins by 500-MHz /sup 1/H-NMR spectroscopy.** Mutsaers, J.H.G.M. (Rijksuniversiteit Utrecht (Netherlands)). 16 Jun 1986. 185p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88700813/JAW.

Includes summary in Dutch and previously published material.

This thesis deals with the structural analysis by 500-MHz / sup 1/H-NMR spectroscopy of carbohydrate chains obtained from glycoproteins. In the chapters 1 to 6 the structural analysis of N-glycosidically linked carbohydrate chains is described. The chapters 7 to 10 describe the structural analysis of O-glycosidically linked carbohydrate chains. 381 refs.; 44 figs.; 24 tabs.; 7 schemes.

12605 **(ORNL/TM—10591) A comparison of algorithms for the analysis of images generated by two-dimensional electrophoresis.** Mann, R.C.; Riese, D.J.; Mansfield, B.K.; Selkirk, J.K. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003730/JAW.

Three algorithms for quantitative 2d gel electrophoresis were compared when applied to a set of simulated images, and to gel images obtained with separated cytoplasmic proteins of FELC. The methods involved fitting of Gaussian surfaces to protein spots as well as quantitation that did not rely on any assumptions concerning the distribution of radioactivity within a protein spot. Image processing algorithms preceding the analysis were identical for the three methods. Results based on isolated spots show that for the majority of cases there is no statistical difference between the estimates produced by the three methods. This suggest that computationally expensive fitting of two-dimensional surfaces is not necessary in order to achieve satisfactory quantitation. 18 refs., 1 fig., 2 tabs.

12606 **(PB—88-106174/XAB) Strategies for using bioassay methods for the identification of hazardous components and comparative risk assessment of complex mixtures.** Lewtas, J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1987. 41p. (EPA—600/D-87/271). NTIS, PC A03/MF A01.

Two strategies particularly useful for approaching the toxicology of complex mixtures are: (1) bioassay-directed chemical

characterization; and, (2) comparative bioassay studies. Bioassay-directed fractionation and chemical characterization is a strategy for identifying biologically active compounds or compound classes in complex mixtures. The identification and assessment of mutagens and carcinogens in complex mixtures has been significantly advanced by the use of short-term genetic bioassays. Bioassay-directed fractionation coupled with new organic characterization methods has provided the tools needed to more efficiently identify potential carcinogens in complex mixtures. A comparative potency strategy for evaluating the relative toxicity, mutagenicity, and carcinogenicity of a series of different mixtures has been used to provide comparative potency data for risk assessment. The comparative mutagenicity and carcinogenicity of a series of combustion emissions has been assessed using dose-response studies in bacteria, mammalian cells, and rodents.

12607 **Intact gene and method of excising and cloning same.** McCutchan, T.F.; Dame, J.B. (to Secretary of the Dept. of Health and Human Services, Washington, DC). US Patent 4,707,445. 17 Nov 1987. Filed date 31 Jul 1984. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A process for excising from a genomic DNA a complete sequence for encoding a protein which comprises treating a genomic DNA susceptible to mung bean nuclease and formamide under controlled conditions in a reaction mixture comprising mung bean nuclease and formamide in an amount sufficient for excising in a single step, directly form the genomic DNA, a complete nucleotide sequence encoding a protein when the nucleotide sequence is cloned in a foreign expression vector. The excised nucleotide sequence has protein initiation and termination codons.

12608 **Disturbances in DNA precursor metabolism associates with exposure to an inhibitor of poly(ADP-ribose) synthetase.** Milam, K.M.; Thomas, G.H.; Cleaver, J.E. (Univ. of California, San Francisco). *Experimental Cell Research;* 165: 260-268(1986). Contract AC03-76SF01012.

3-Aminobenzamide (3AB) is widely used as an inhibitor of poly(ADP-ribose) synthetase to study the effect of protein ribosylation on various cellular processes, but the specificity of its inhibition has not been demonstrated. We found that 3AB has a wide range of effects on DNA percursor metabolism, as determined by high-performance liquid chromatographic separation of deoxynucleosides derived from enzymatic digestion of cellular DNA. 3AB (10-20mM) significantly reduced cell growth in human lymphoblastoid cells. Furthermore, the incorporation of [^{3}H]deoxycytidine into DNA was significantly enhanced relative to incorporation of [^{3}H]deoxythymidine, [^{3}H]deoxyguanosine, and [^{3}H]deoxyadenosine. Incorporation of fragments of [^{3}H]glucose into the pyrimidine fraction of DNA was significantly inhibited relative to incorporation into the purine fraction. At only 1 mM, 3AB had a major inhibitory effect on the incorporation of the methyl group from [^{3}H]methionine into deoxyguanosine, deoxyadenosine, and deoxycytidine, with 50% inhibition into deoxyguanosine and deoxyuadenosine and 90% inhibition into deoxycytidine. The specificity of 3AB inhibition to poly(ADP-ribose) synthetase is therefore doubtful in view of this variety of metabolic effects, involving pyrimidine synthesis and de novo synthesis via the one-carbon pool.

5503 Cytology

REFER ALSO TO CITATION(S) 12608, 12722, 12729

12609 **(PB—88-107214/XAB) Assessment of the TLC/Salmonella assay for screening hazardous wastes.** Houk, V.S.; Claxton, L.D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1987. 22p. (EPA—600/D-87/242). NTIS, PC A03/MF A01.

Using a modified version of the TLC/Salmonella assay developed by Bjorseth et al. (1982), 10 complex hazardous wastes were tested for mutagenic activity. The method couples thin-layer chromatography (TLC) with the Salmonella/mammalian-microsome (Ames) assay for the detection of mutagenic constituents in complex mixtures. Crude hazardous wastes and selected hazardous waste extracts were fractionated on commercially available cellulose TLC plates. Mutagenicity testing was performed by applying a single overlay of minimal growth agar containing a tester strain of Salmonella and the optional metabolic activation system directly onto the developed chromatogram. Seven of 10 hazardous wastes demonstrated mutagenic activity when tested by the method. To assess the sensitivity of the modified TLC/Salmonella assay, 14 Salmonella mutagens from a wide range of chemical classes and polarities were tested. Eleven of the 14 mutagens were positive in the test system.

12610 **(PB—88-113642/XAB) US Environmental Protection Agency's guidelines for mutagenicity risk assessment and some comments on aneuploidy.** Dellarco, V.L.; Jacobson-Kram, D. (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Sep 1987. 18p. (EPA—600/D-87/312). NTIS, PC A03/MF A01.

This paper describes the risk assessment strategy used by the U.S. Environmental Protection Agency (EPA) to evaluate mutagenic risk. The Agency considers all endpoints relevant to genetic risk. Evaluating and quantifying risk is not a straightforward process and requires many assumptions. The U.S. EPA mutagenicity guidelines should not be regarded as comprehensive or complete, but rather providing a reasonable guide for using toxicological data in assessing genetic risk. Because of the dynamic nature of the area, as new information is gained, the Guidelines will be updated and modified if necessary.

5504 Genetics

REFER ALSO TO CITATION(S) 11158, 11203, 12607, 12637, 12663, 12702, 12703, 12706, 12707, 12709, 12718, 12719, 12720, 12723, 12724, 12725, 12727, 12755

12611 **(CONF-870701—14) Somatic mutation and cell differentiation in neoplastic transformation.** Huberman, E.; Collart, F.R. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002909/JAW.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

In brief, the authors suggest that tumor formation may result from continuous expression of growth facilitating genes that, as a result of irreversible changes during the initiation step, are placed under the control of genes expressed during normal differentiation. Thus, to understand carcinogenesis, we must decipher the processes that lead to the acquisition of a mature phenotype in both normal and tumor cells and characterize the growth dependency of tumor cells to inducers of cell differentiation. Furthermore, the growth of a variety of tumors may be controlled through the use of inducers of maturation that activate genes located beyond the gene that is altered during tumor initiation. 22 refs., 3 figs.

12612 **(DOE/ER/10873—2) Reorganization of mitochondrial genomes of cytoplasmic revertants in cms-S inbred line WF9 in maize.** Escote-Carlson, L.J.; Gabay-Laughnan, S.; Laughnan, J.R. (Illinois Univ., Urbana (USA). Dept. of Plant Biology). Dec 1987. Contract AC02-81ER10873. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002990/JAW.

Cytoplasmic reversion to fertility in cms-S maize has been previously correlated with changes in mitochondrial genome organization, specifically with loss of the autonomously replicating linear plasmid-like DNAs, S1 and S2, and with accompanying alterations in the high molecular weight mtDNA (main genome) that specifically involved S1 and S2 sequences. These studies, however, dealt with cytoplasmic revertants occurring in the cms-VG M825 inbred line and in the cms-VG M825/Oh07 F_1 hybrid. This paper deals principally with patterns of mitochondrial DNA reorganization accompanying cytoplasmic reversion to fertility in the WF9 inbred line nuclear background. Here the free S1 and S2 plasmid-like DNAs are retained in the revertants. Mitochondrial DNA analysis by Southern hybridization using cloned fragments of S1 and S2 shows altered organization around S-homologous regions in the

main mitochondrial genome of revertants as compared with that of the male-sterile parental controls, but the pattern of main genome changes involving these regions differs from that of the cytoplasmic revertants that occurred in M825 and M825/Oh07 backgrounds. 28 refs., 7 figs.

12613 (DOE/OR/00033—T364) Evaluation and application of an in vivo mouse assay for chemically induced sister chromatid exchanges and chromosome aberrations: Annual progress report, September 30, 1986-September 29, 1987. McFee, A.F. (Oak Ridge Associated Universities, Inc., TN (USA)). 15 Oct 1987. Contract AC05-76OR00033. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002398/JAW.

This reporting period constituted the first year of our renewed contract which calls for an increased number of personnel and an increase in the number of chemicals to be tested per year. The majority of our efforts were utilized in the training of personnel and the testing of submitted chemicals. During the year we received from the NIEHS repository coded aliquots of 16 test compounds. Each of these has been evaluated to determine the most desirable vehicle in which to administer them to test animals. The testing of chemicals for SCE induction requires the treatment of 25 mice with varying levels of the test compound and control materials and the scoring of 25 second-division metaphases from each animal. An extended time protocol was adopted which utilizes treatment to sacrifice times of 36 hours for chromosome aberrations and 42 hours for sister chromatid exchange evaluation. The micronucleus assay performed on polychromatic erythrocytes of the bone marrow offers some potential advantages as a cytogenetic assay for clastogenic chemicals. We have initiated a limited study comparing SCE induction by several chemicals which had previously been shown to be positive for SCE's. Where possible, we are administering the same doses of the compounds in suspension or solutions in the three carriers. Chemicals with a variety of solubility characteristics (and all being SCE positive) will be utilized to provide data on the possible influence of the solvent/carrier on mutagenic potency. 5 refs.

5505 Metabolism

REFER ALSO TO CITATION(S) 10677, 12733

12614 (INIS-mf—10796) Changes in the epidermal blood flow and its water distribution as a result of burns. Torunsky, R.H. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88751923/JAW.

In an animal experiment (44 rabbits) the capillary flow disturbance and edema development from small surface burns of the second degree (max. 3% of the body surface) were studied. The measurement of the capillary flow was done with 99mTc-marked erythrocytes, the description of the burn edema with diffundibular 99mTc pertechnetate. The burn edema was by the third day mostly gone whereas the capillary flow on the contrary had in this time only worsened. (orig./TRV).

5506 Medicine

REFER ALSO TO CITATION(S) 10771, 11056, 11149, 12014, 12043, 12298, 12658, 12690, 12715, 12726, 12729, 12766, 13496

12615 (CONF-870524—1) The relationship of drinking water chlorination and serum lipids in human populations. Zeighami, E.A.; Watson, A.P.; Craun, G.C. (Oak Ridge National Lab., TN (USA); Environmental Protection Agency, Cincinnati, OH (USA)). 1987. Contract AC05-84OR21400. 20p. NTIS, PC A03. Order Number DE87013873/JAW.

From 6. conference on water chlorination: environmental impact and health effects; Oak Ridge, TN, USA (3 May 1987).

This research tests hypotheses concerning the relationship between drinking water characteristics and the cardiovascular disease risk factors blood pressure and serum lipids, as well as thyroid function. The study used a cross-sectional survey design to examine the characteristics of the cardiovascular disease risk factors in residents of forty-six small communities in central Wisconsin. Twenty of the communities chlorinated the water supply, and twenty-six did not. Within each of the chlorination groups, approximately half the communities had hard water and the other half had soft drinking water. This report examines the relationship of chlorination to serum lipid levels in the forty-six communities. Serum cholesterol levels were significantly higher in chlorinated communities for females. Levels of serum cholesterol were also higher in chlorinated communities for males, but the difference was not as great, nor was it statistically significant. LDL levels were higher in chlorinated communities, but did not reach statistical significance for either sex. Levels of high-density lipoprotein cholesterol were related to calcium level of the drinking water within the hardness categories, but only in the chlorinated communities. Thus chlorine and calcium level in the drinking water may interact in some way which affects levels of HDL cholesterol. 24 refs., 1 fig., 2 tabs.

12616 (DOE/ER/60418—T1) Instrumentation and quantitative methods of evaluation: Progress report for the period January 15, 1987 through September 14, 1987. Beck, R.N. (Chicago Univ., IL (USA)). Sep 1987. Contract FG02-86ER60418. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87013639/JAW.

This report describes various research projects involving NMR imaging techniques. Included are brief descriptions of improvements to existing equipment, modifications in computer codes controlling image processing, and methods for improving the accuracy of diagnostic techniques. (TEM)

12617 (DOE/ER/60597—1) Continuing experimental investigations with radiolabeled anti-collagen antibodies and related antibodies: Progress report, May 1, 1987 through November 30, 1987. Gottschalk, A. (Yale Univ., New Haven, CT (USA). School of Medicine). 1987. Contract FG02-87ER60597. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003382/JAW.

The basic research goal is to develop an in vivo probe with histopathologic correlates that can be used to characterize irradiation lung injury. Irradiation lung injury is a very important problem in patients receiving total body irradiation prior to bone marrow transplantation for diseases such as leukemia. Basic research defining irradiation lung injury will have important clinical significance. We have developed a simple jig to hold the Sprague-Dawley rat during irradiation, and have successfully shielded all but the right lung. Dosimetry studies were performed and we found that we were delivering a dose to the rats mid-lung of 1 Gy/min from the experimental therapy machine. We confirmed the region of pulmonary irradiation not only with radiographic studies of the jig in place, but also with injections of technetium-labeled-MASS in some of our 25-day rats. This showed a profound perfusion deficit compatible with irradiation involving the entire right lung confirming successful placement of the irradiation portal. All of the experiments we describe employed a dose of 25 Gy. 1 fig., 3 tabs.

12618 (ENEA-RT-PAS—85-14) Direct methods for determining internal contamination. Melandri, C. (ENEA, Bologna, Italy. Dipt. Protezione ambientale e Salute dell'Uomo). (ENEA, Rome (Italy)). 1985. 120p. (In Italian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88700990/JAW.

The direct methods of investigation on body content of radionuclides emitting gamma rays with energies higher than 100 KeV are described. After a short review of the earlier methods, the main technical charateristics of the present used whole body counters and counting geometries are described together with the calibration methods. Qualitative and quantitative data interpretation are also briefly discussed. The minimum detectable activity and the Derived Investigation Levels at different times from the intake both by ingestion or by inhalation as aerosol are finally compared for some radionuclides of great importance in the health physic survey.

12619 **(INIS-mf—11075) Czechoslovak congress of radiology with international participation. Abstracts.** (Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia)). 1986. 141p. (In English and German). (CONF-8605317—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88700881/JAW.

From Czechoslovak congress of radiology; Prague, Czechoslovakia (5 May 1986).

The booklet contains 125 abstracts of papers presented at the congress, dealing with diagnostic and therapeutic applications of X-rays, /sup 60/Co, /sup 137/Cs, betatron radiation, with scintigraphy, angiography, lymphography, with radiosensitizers, contrast media and with a host of activities performed and results achieved at radiological departments. (A.K.).

12620 **(INIS-mf—11080) II. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene.** (Ceskoslovenska Spolecnost Nuklearni Mediciny a Radiacni Hygieny). [26 Nov 1986]. 209p. (In Czech and Slovak). (CONF-8610369—). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88700822/JAW.

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

English translation available from Nuclear Information Center, 156 16 Prague 5-Zbraslav, Czechoslovakia at US$ 10 per page. .

The proceedings contain 165 abstracts of papers covering all areas of the application of nuclear medicine, such as osteology, cardiology, immunology, neurology, oncology, etc. The topics include the examination of the skeleton with radioisotopes, various immunology methods, scintiscanning of body organs, tumor monitoring, radiopharmacology aspects, biological radiation effects, cytogenetic changes following irradiation, and studies of radiation effects on DNA repair. Separate volumes are devoted to education of technicians, processing of radioisotope examination data, radiation protection and decontamination. (M.D.)

12621 (INIS-mf—11084, pp 43) **Quantitative computed tomography for femur neck mineral assessment.** Van Papendorp, D.H. (Pretoria Univ., South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12622 (INIS-mf—11084, pp 44) **Proton beam method for determination of fluorine concentrations in teeth.** Eloff, G.A.; Du Preez, I.C.; Mingay, D.W. (Medical Univ. of Southern Africa, Pretoria, South Africa; Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria. Dept. of Physics). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12623 (INIS-mf—11084, pp 40) **Effect of different flood field correction methods on reconstructed spect images.** Van Aswegen, A.; Sweetlove, M.A.; Loetter, M.G.; Minnaar, P.C. (University of the Orange Free State, Bloemfontein, South Africa. Dept. of Biophysics). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12624 **(INIS-mf—11603) Radioimmunological proof of thyroglobulin antibodies in humans by the use of a double antibody method.** Waller, V. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 2 Dec 1982. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88751928/JAW.

Thyroid antibodies, especially thyroglobulin antibodies, allow themselves to be proven with the double antibody method, in competitive radio binding assays and with the solid phase technique. These methods offer advantages relative to sensitivity and quantifiability. In this work a sensitive radioimmunoassay as a double antibody method was worked out whereby a 125 I-thyroglobulin/thyroglobulin antibody immune complex was precipitated out using anti-human immunoglobulin. The measured results from the radioimmunoassay show a good correlation with the results of the immune histological findings. A high to very high Tg antibody level occurs with autoimmune thyroiditis (80%), primary hypothyroidism (74%) and hyperthyroidism (70%). The control values with healthy people came to less than 5% specific binding. In correlation with the results of other authors this method is advantageous relative to test start and evaluation procedures.

12625 **(INIS-mf—11604) Computed tomographic investigations on intraventricular hematomas.** Laber-Szillat, S. (Frankfurt Univ. (Germany, F.R.). Fachbereich Humanmedizin). 24 Aug 1982. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88751929/JAW.

This work investigated in 106 patients with intraventricular hematomas all the known factors which can have an influence on prognosis: age, sex, anamnesis of the patients, size, extent and localization of the intracranial bleeding, underlying angiopathy and differences between arterial and venous and spontaneous and traumatic bleedings. It was shown that the state of mind was the deciding prognostic factor, whereby viligance was the cumulative expression of all other investigated influences. A computed tomography (CT) examination is deciding in the question of operative hydrocephalus care. In 13 patients it was further shown, how clearly CT results and brain dissection allowed themselves to be compared. The computed tomographic examination method is best suited to achieve even physiological and more extensive prognostic possibilities.

12626 **(INIS-mf—11605) Radioimmunological determination of the level of luteinizing hormone in the serum in the case of various gonadal disturbances and other endocrine diseases.** Schiebe, C. (Frankfurt Univ. (Germany, F.R.). Fachbereich Humanmedizin). 22 Jan 1982. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88751930/JAW.

The purpose of this work was to determine radioimmunologically the level of luteinizing hormone (LH) in the serum in the case of various gonadal disturbances and other endocrine diseases with the aid of the double antibody method, and to compare the results within different diagnosis groups to each other and to compare these results with those found in the published literature. It was tested whether and with which accuracy the radioimmunological determination of LH in the serum can contribute to the diagnosis of pituitary gonad diseases and whether in the case of endocrine diseases the accompanying disturbances of the gonadotropin secretion which primarily do not affect the hypothalamo - hypophyso - gonadal circuit are demonstrable. The study results for the diagnosis groups primary and secondary hypogonadism of various genesis, gynacomastia, impotentia coeundi, primary and secondary ovarial insufficiency, hirsutism and adiposity were presented and discussed.

12627 **(INIS-mf—11606) Results of the treatment of patients with chronic myeloid leukemia at the Medical Clinic of the University of Tuebingen 1969-1978.** Pfeilsticker, U. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88751931/JAW.

The results of treatment of 111 patients with myeloid leukemia at the Medical Clinic of the University of Tuebingen from the years 1969 to 1971 were evaluated under a testing, which occurred at the same time, of the therapeutically differential importance of the spleen size before the beginning of therapy and of the influence of various factors on the treatment success of spleen irradiation. The median survival time of the 111 patients after diagnosis was 43 months. The primary busulfan therapy increased survival time in comparison to the therapy with spleen irradiation, but not statistically significantly. With more greatly enlarged spleens there was no recognizable advantage in either form of treatment. For a better

evaluation of the therapy success stricter remission criteria appeared to be required.

12628 **(INIS-mf—11607) Cranium-brain trauma in computed tomographs - diagnosis and clinical correlation.** Wrasse, K. (Freie Univ. Berlin (Germany, F.R.)). 6 Aug 1982. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88751932/JAW.

For the successful treatment of intracranial complications in the case of cranium-brain trauma a quick and exact diagnosis is necessary. The goal of this work was to test and evaluate the effectivity of computed tomography for neurotraumatology. Using 565 patients, who were acutely or at one time suffering from a cranium-brain trauma, the high validity of computed tomography for these injuries was proven. The following areas in question were studied with respect to the value of computed tomography in comparison to them: angiography, X-ray diagnostic, echoencephalography, brain scintigraphy, electroencephalography and neurological-psychopathological findings from cranium-brain trauma. Statement possibilities and difficulties of computed tomography are discussed in the cases of the following neurotraumatological diseases: extracranial hematomas; acute cranium-brain traumas; traumatic arachnoidal bleeding; diffuse brain edema; transtentorial herniation and brain contusions. At the end the diagnostic and therapeutic procedures in the case of cranium-brain trauma are presented.

12629 **(INIS-mf—11611) Ventricular function after operative correction of chronic mitral insufficiency. Non-invasive study with technetium-99m pertechnetate. First passage technique.** Bougioukas, G. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 25 May 1982. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88751935/JAW.

14 patients (age 49.6 +- 13.3 years) with pure mitral insufficiency of the second to fourth degree underwent an operative intervention on the mitral valve, whereby in 12 cases the valve was replaced and two times the insufficiency could be cleared up with a plastic reconstruction. On the average of 21.6 +- 11 months after the operation a non-invasive study was done with the help of heart scintigraphy 'first passage technique' with Tc 99m pertechnetate at rest and at maximum ergometeric stress. With this method pre- and postoperative end-diastolic volumes (227/ 114 ml), end-systolic volumes (69/ 46 ml), heart minute volumes (4.5/ 5.7 l/min), total output fraction of the left ventricle (61/ 69%), diastolic filling speed and emptying speed of the ventricle were determined as well as the measuring of the lung flow time. The speed of the rapid filling phase gave no indication of a hindrance as a result of an implanted valve or a plastic reconstruction. The changes under stress indicate a normal reaction of the ventricle. This ability to react corresponds clinically to the improvement of the patients on the average of 1.1 degrees according to the NYHA classification. (orig./ TRV).

12630 **(LA-UR—87-3915) Surface modification of polymeric materials and its effect on blood compatibility.** Wroblaski, D.A.; Cash, D.L.; Archuleta, T.; Barthell, B.L.; Kosowsky, R.; London, J.E.; Lehnert, B.E.; Duchane, D.V. (Los Alamos National Lab., NM (USA); Pennsylvania State Univ., University Park (USA)). 1987. Contract W-7405-ENG-36. 7p. (CONF-8711102—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003160/JAW.

From Symposium on biomedical materials and devices; Boston, MA, USA (30 Nov 1987).

The surfaces of commercially available polymeric materials have been modified through the chemical infusion process and physical vapor deposition. The surfaces of poly(methylmethacrylate) (PMMA) have been modified through a chemical infusion process by treatment of the sample with a solution containing varying amounts of titanium(IV)isopropoxide and polyvinylpyrrolidone (PVP). The surfaces of silicone rubber samples have been coated with a thin coating of titanium dioxide with an ion beam sputtering technique. The treated samples were characterized by scanning electron microscopy, optical microscopy, and neutron activation analysis. The infused samples were evaluated for blood compatibility using two biological assays: an adherence assay in which the adherence of human polymorphonuclear leukocytes to the samples was determined, and a hemolysis assay using rat blood erythrocytes to determine the hemolytic activity of the samples. Based on the results of these assays, the PMMA samples treated with PVP alone resulted in an improvement in reactivity with the blood cells. 16 refs., 4 figs.

12631 **(LUNFD6-NFRA—1019-1-61-1986) In vivo elemental analysis inoccupational medicine using X-ray fluorescence.** Christoffersson, J.O. (Lund Univ. (Sweden). Dept. of Radiation Physics). 24 Oct 1986. 67p. (LUMEDW-MERI—1019-1-61-1986). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751472/JAW.

A technique for the in vivo determination of cadmium in the kidney cortex using X-ray fluorescence analysis (XRF) has been developed for clinical use. The method uses the Cd K-alfa X-rays. The radiation from the tube was polarized by scattering at 90 degrees in a plastic disc. Using a Si(Li) detector the minimum detectable concentration (MDC) of cadmium in the renal cortex was about 6 ppm for an effective dose equivalent of 3 micro-Sievert. The precision of the method was estimated to be about 23 percent. The clinical usefulness was confirmed by studying 20 occupationally exposed cadmium workers and three controls. The cadmium workers showed levels of cadmium in the kidney in the range 47-317 ppm, and controls showed levels below 30 ppm. Using XRF in vivo large-scale measurements of lead in the fingerbone of more than 100 lead workers were performed. The technique used included two 57-Co sources for excitation and a higher-purity Ge detector for the analysis of the Pb K-alfa X-rays. The MDC was about 20 ppm for an effective dose equivalent of 0.1 micro-Sievert. The precision of the method was estimated to be about 15 per cent. The in vivo measurements showed levels of fingerbone-Pb up to 148 ppm. The existence of a significant endogenous exposure from lead in the skeleton was confirmed. The fingerbone-Pb was correlated to time-integrated blood-Pb indicating that it could be used as a rough estimated of time-integrated exposure. The results from the measurements were used to develop a three-compartment (cortical bone, trabecular bone, blood/soft tissues) model. Using this model, lead levels in fingerbone, vertebrae and blood could be predicted in good agreement with observations. With 123 refs.

12632 **(SIS—1987:6) Phototheraphy of hyperbilirubinemia in newborn children.** Christensen, T.; Reitan, J.B. (Statens Inst. for Straalehygiene, Oslo (Norway)). 1987. 71p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751314/JAW.

A certain increase in the concentration of bilirubin can normally be observed in newborns and particularly in premature children. Bilirubin is a toxic substance. Phototherapy can efficiently reduce the concentration of bilirubin in the body. According to recent research, green light is probably the most efficient in phototherapy. The mechanism behind the therapy is photoisomerization of bilirubin which makes the excretion of bilirubin easier. The excretion of photoisomers can take place without conjugation with glucuronic acid. However, a certain risk of unwanted side effects exists. Most of these are not as serious as the result of bilirubin toxicity. Long term side-effects of phototherapy can not be excluded. This is due to the short obervation time of treated patients. One should be particularly aware of genotoxic effects which can lead to the development of cancer. The use of phototherapy in Norway is widespread. A proportion between one and ten percent of the newborn children are treated with light for shorter or longer periods. According to Norwegian experiences the treatment works well and does not lead to any or only few complications. However, in accordance with the general impression the control of the light doses is not good enough in the normal clinical situation. 79 refs.

12633 **Immunologically active peptides capable of inducing immunization against malaria and genes encoding therefor.** Dame, J.B.; Williams, J.L.; McCutchan, T.F.; Schneider, I. (to Secretary of the Army, Washington, DC). US Patent 4,707,357. 17 Nov 1987. Filed date 26 Jun 1984. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An antimalarial immunogenic stimulant is described comprising an immunogenic carrier and a peptide sequence of between 2

and 1000 consecutive repeats of a sequence Asn-X-Y-Pro, wherein X is Ala or Val and Y is Asn or Asp.

12634 **Local dosimetry of internally deposited Auger emitters.** Paschoa, A.S.; Wrenn, M.E.; Yasui, L. (Univ. of Utah, Bldg. 351, Salt Lake City, UT 84112). pp 113 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

The local dosimetry of Auger electrons emitted by electron capture (EC) nuclides purposefully incorporated into subcellular structures has been recognized to be of great importance for cellular toxicity studies. Auger electron emitters such as /sup 125/I (60.2 d, 100% EC), /sup 77/Br (57 hr, 99.3 EC), /sup 75/Se (119 d, 100% EC), and /sup 67/Ga (78.3 hr, 100% EC) are commonly used in survival studies. All EC nuclides emit a cascade of Auger electrons with varying energies and ranges, and a residual highly charged decay nucleus. However, estimates of the subcellular dose from the /sup 125/I Auger electrons have shown that the M-XY Auger electron contributes almost all its dose to the CHO cell nucleus. In addition, it is known that the fraction of energy emitted in the form of Auger electrons increases for lighter elements, making the need to refine the local Auger electron dosimetry of /sup 77/Br, /sup 75/Se, and /sup 67/Ga at least as important as the knowledge of local dosimetry of the /sup 125/I Auger electrons. Since naturally-occurring /sup 40/K also decays by EC to /sup 40/Ar about 11% of the time, this paper discusses local dosimetry of /sup 77/Br, /sup 75/Se, and /sup 67/Ga compared to that of /sup 125/I, and that of /sup 40/K.

5507 Microbiology

REFER ALSO TO CITATION(S) 10777

12635 (DOE/PC/79863—T5, pp 47-53) **Microbial removal of organic sulfur from coal (bacterial degradation of sulfur-containing heterocyclic compounds).** Klubek, B.; Clark, D. 1987. NTIS, PC A06/MF A01. Order Number DE88001332/JAW.

In High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, July 18, 1987-September 26, 1987.

The presence of substantial levels of sulfur in coal is a major source of air pollution, and considerable efforts are being made to devise a cost-effective way of removing it. One method is to mutate a laboratory species, Escherichia coli, an organism which is genetically well-understood and whose pathways for the metaboiism of sulfur-containing amino acids have been extensively investigated. Such thiophene degraders can be genetically analyzed and the genes involved can be cloned in order to amplify their products. The second approach is the development of naturally occurring bacteria capable of thiophene degradation. Enrichment culture techniques, mutagenesis of current isolated strains, and mixed culture studies with crushed coal comprise an alternative approach in our study. The degradation rates of our model-thiophene compounds and the preliminary testing of our isolates with coal will index the efficiency of our strains in coal desulfurization. Ultimately, the genes responsible for thiophene degradation by our isolated strains will be transferred to our E. coli strain, creating a single organism capable of degrading a broad spectrum of thiophene compounds. 2 tabs.

5509 Pathology

REFER ALSO TO CITATION(S) 10806, 11613, 12448, 12603, 12610, 12615, 12757, 12758

12636 (DOE/ER/13179—T1) **Role of turgor pressure and solute transport in plant cell growth: Progress report.** Cosgrove, D.J. (Pennsylvania State Univ., University Park (USA). Dept. of Biology). 15 Oct 1987. Contract FG02-84ER13179. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002132/JAW.

Plant cell expansion requires coordinationion of three distinct processes: wall relaxation and synthesis, water uptake, and solute uptake. Wall relaxation reduces cell turgor pressure and thereby generates the reduced water for water potential needed uptake. Our studies with pea (Pisum sativum L.) and soybean (Glycine max Merr.) seedlings have shown that water uptake is rapid and is not a major control point for growth. Our current focus is on the processes of wall relaxation and solute transport, and how they are influenced by water stress. One major goal of this project is to examine in detail the dependence of wall yielding on turgor pressure. This is being done by detailed measurements of wall relaxation in living cells, using a computer-assisted pressure microprobe and the new pressure-block technique. Our pressure-block results indicate that wall relaxation is more dynamic than expected. Rapid changes in wall yielding appear to compensate for minor fluctuations in cell turgor pressure, thus maintaining stable growth rates. A second major goal of this project is to determine the interrelationship between cell expansion and solute transport into expanding cells. We will selectively block either cell expansion or solute transport, and measure the effect of such blockage on the unblocked process. A third goal is to examine the basis for reduced cell expansion when plants are water stressed. Our results indicate that growth is retarded in part because of reduced turgor pressure, and in part because of reduced cell wall relaxation. The alteration in wall relaxation will be examined by in-vivo relaxation methods. Thus studies will provide insight into the basic cellular and physical processes controlling plant growth, and how they are perturbed by water stress. 8 refs., 1 fig.

12637 (PB—88-106984/XAB) **Assessment of hazardous wastes for genotoxicity.** DeMarini, D.M.; Houk, V.S. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1987. 14p. (EPA—600/D-87/285). NTIS, PC A03/MF A01.

The authors have evaluated a group of short-term bioassays to identify those that may be suitable for screening large numbers of diverse hazardous industrial wastes for genotoxicity. Fifteen wastes (and dichloromethane extracts of these wastes) from a variety of manufacturing processes were tested for mutagenicity in Salmonella typhimurium strains TA98 and TA100 with and without Aroclor 1254-induced rat-liver S9. Ten of these wastes were fed by gavage to F-344 male rats, and the raw urines were assayed for mutagenicity in the presence of beta-glucuronidase in strain TA98 with S9. Six of these urines were extracted by C18/methanol elution, incubated with beta-glucuronidase, and evaluated in strain TA98 with S9 and beta-glucuronidase. Fourteen of the wastes were examined for their ability to induce prophage lambda in Escherichia coli in a microsuspension assay. A second set of wastes, consisting of four industrial wastes, were evaluated in Salmonella and in a series of mammalian cell assays to measure mutagenicity, cytogenetic effects, and transformation.

12638 (PB—88-107545/XAB) **Viral infections based on clinical sampling at a spray irrigation site.** Camann, D.E.; Moore, B.E. (Southwest Research Inst., San Antonio, TX (USA)). Sep 1987. 21p. NTIS, PC A03/MF A01.

The Lubbock Infection Surveillance Study (LISS) monitored viral and bacterial infections in a semiarid rural American community surrounding a major new land-treatment demonstration project. The viral investigation examined the association of new viral infections in residents and workers and their exposure to infectious viruses through slow rate (sprinkler) land application of wastewater. Viral infections were detected both through serologic assay of semiannual blood samples and through clinical virological analysis by tissue culture techniques of monthly routine fecal specimens. The paper presents the results of the clinical sampling for viral infections.

12639 (PB—88-113378/XAB) **Assessment of the Microscreen phage-induction assay for screening hazardous wastes.** Houk, V.S.; DeMarini, D.M. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1987. 25p. (EPA—600/D-87/241). NTIS, PC A03/MF A01.

The Microscreen phage-induction assay, which quantitatively measures the induction of prophage lambda in Escherichia coli WP2s(lambda), was used to test 14 crude (unfractionated) hazardous industrial waste samples for genotoxic activity in the presence and absence of metabolic activation. Eleven of the 14 wastes induced prophage, and induction was observed at concentrations as low as 0.4 picograms per ml. Comparisons between the mutagenicity of these waste samples in Salmonella and their ability to induce prophage lambda indicate that the Microscreen phage-induction assay detected genotoxic activity in all but one of the wastes that were mutagenic in Salmonella. Moreover, the Microscreen assay detected as genotoxic 5 additional wastes that were not detected in the Salmonella assay. The applicability of the Microscreen phage-induction assay for screening hazardous wastes for genotoxic activity is discussed along with some of the problems associated with screening highly toxic wastes containing toxic volatile compounds.

12840 **(PB—88-127055/XAB) Unfinished business: a comparative assessment of environmental problems. Appendix 1. Report of the Cancer Risk Work Group.** (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). Feb 1987. 226p. (EPA—230/2-87/025B). NTIS, PC A11/MF A01.

See also Overview Report, PB—88-127048, and Appendix 2, PB—88-127063; Also available in set of 5 reports PC E99, PB—88-127030.

The report is one of four reports comparing risks currently associated with major environmental problems. Cancer risk associated with 31 environmental problem areas under EPA's jurisdiction was evaluated and then ranked according to the relative magnitude of the cancer risk. The report discusses the process used for ranking the environmental problems, identifies the difficulties encountered in evaluating cancer risks and presents the relative rankings. It also highlights several issues that affected the ranking of specific environmental problems. The ranking should not be regarded as a list establishing priorities for regulation.

12841 **(PB—88-853965/XAB) Toxicity of cobalt. January 1970-November 1987 (citations from the NTIS data base). Report for January 1970-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 100p. NTISPC N01/MF N01.

Supersedes PB—86-854189.

This bibliography contains citations concerning the toxicity, carcinogenicity, environmental pollution, and other adverse effects of cobalt. The detection, analytical methods, and standards are considered, and methods of removal from the environment are discussed. The effects on aquatic and terrestrial flora and fauna, including humans, are considered. (This updated bibliography contains 171 citations, 17 of which are new entries to the previous edition.)

5520 Public Health

REFER ALSO TO CITATION(S) 11821, 12453, 12595, 12638, 12748

12842 **(PB—88-105903/XAB) NIOSH (National Institute for Occupational Safety and Health) grants: research and demonstration projects: annual report, Fiscal year 1986.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1987. 271p. (DHHS/PUB/NIOSH—87-109). NTIS, PC A12/MF A01.

The National Institute for Occupational Safety and Health (NIOSH) plans, directs, and coordinates a national program of research, training, and related activities to prevent occupational diseases and injuries among workers in the United States. Under the provisions of the Occupational Safety and Health Act of 1970 and the Federal Mine Safety and Health Amendments Act of 1977, research investigations constitute a principal responsibility of NIOSH. In turn, the support of outstanding extramural research is a major component of the research program. The report is published by NIOSH to provide a readily available source of information on the status and scope of the Institute's research grants program of NIOSH as a means of stimulating the development of proposals for research of high quality on significant occupational safety and health problems. In this, the authors invite the interest of scientists in the biomedical sciences, engineering, and related disciplines. Descriptions of all active grants during fiscal year 1986 (October 1, 1985 to September 30, 1986) are included, along with the publications resulting from the research.

12843 **(PB—88-127089/XAB) Unfinished business: a comparative assessment of environmental problems. Appendix 4. Welfare Risk Work Group.** (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). Feb 1987. 103p. (EPA—230/2-87/025E). NTIS, PC A06/MF A01.

See also Appendix 3, PB—88-127071; Also available in set of 5 reports PC E99, PB—88-127030.

The report is one of four reports comparing risks currently associated with major environmental problems. Ranking the 31 environmental problems according to the severity of the actual and potential welfare damages they may cause was difficult, principally because of the incomplete information about their effects and different levels of aggregration among the problems. Many types of welfare effects have never been assessed comprehensively. Because of the paucity of information, these rankings to a great degree depend on subjective evaluation. Environmental problems were ranked within five distinct categories of welfare losses. These are soiling and material damages (Chapter 2), recreational losses (Chapter 3), damage to natural resources (Chapter 4), damage to commercial and public property and to ground-water supplies (Chapter 5), and losses in aesthetic and nonuser values (Chapter 6). To give readers a better basis for understanding these rankings, the Introduction discusses the procedures followed in ranking the welfare effects and discusses some methodological issues associated with the effort. Chapter 7 of the report presents a detailed rationale for the ranking and some recommendations based on the results of the effort.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 10750, 11608, 12295, 12603, 12612, 12636

12844 **(CONF-8711103—1) International cooperative effort to establish ASTM [American Society for Testing and Materials] standards for the measurement of radiation dose for food processing.** Farrar, H. IV. (Rockwell International Corp., Canoga Park, CA (USA)). 1987. Contract AC03-83SF11903. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002702/JAW.

From 3. Engineering Foundation conference on advancing food technology with the irradiation process; Santa Barbara, CA, USA (15 Nov 1987).

A task group has been formed within the American Society for Testing and Materials (ASTM) specifically to develop standards for measuring radiation dose for food processing. The task group, which has 78 members, including 16 from Europe, consists of a broad cross section of food industry, government, regulatory, manufacturing, and university interests. The group is working on seven standards; three specifically for food irradiation applications, and four for using specific dosimeter types for all radiation applications, including food processing. Together, this set of standards will specify acceptable methods of accomplishing the required irradiation treatment of food and other products, and will be available for adoption by regulatory agencies in food irradiation protocols. 1 tab.

12845 **(DOE/CH/10288—7) Radiation induced changes in the cuticular hydrocarbons of the granary weevil and their relationships to desiccation and adult mortality: Annual report, February 16, 1987-November 20, 1987.** Sriharan, S. (Selma Univ., AL (USA)). 1987. Contract FG02-86CH10288. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003501/JAW.

The overall goals and objectives as envisaged for the year (1987) have been pursued. The report of the work may broadly be outlined into two components: post irradiation mortality studies at different combinations of temperature and humidity (studies on the rate of moisture-loss in irradiated weevils and correlation with mortality); and extraction of epicuticular hydrocarbons Sitophilus granarius (L) for both irradiated and control (elucidate the after effects of irradiation and determination of radiation induced changes if

any, in the cuticular hydrocarbons of weevils as a result of gamma radiation). 25 figs., 6 tabs.

12646 (INIS-mf—11059-Vol.11-No.1) **Food Irradiation Newsletter. Vol. 11, No. 1.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Apr 1987. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700808/JAW.

Hard copies are available from Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.

This issue reports a number of activities which took place during the second half of 1986 and early 1987: In Point of Fact - Food Irradiation was published in February 1987; Twenty-five participants joined the FAO/IAEA Study Tour on Radiation Disinfestation of Grain which visited the Netherlands, Hungary and the USSR from 18 August to 5 September 1986; An IFFIT training course was held in 1986; Report of the results of feeding trials of irradiated food in human volunteers in the People's Republic of China; An up-dated list of clearances of irradiated foods in different countries.

12647 (INIS-mf—11059-Vol.11-No.1, pp 33-41) **Results of feeding trials of irradiated diets in human volunteers: Summary of the Chinese studies at the FAO/IAEA Seminar for Asia and the Pacific on the practical application of food irradiation, Shanghai, People's Republic of China, 7-11 April 1986.** Brynjolfsson, A. (Massachusetts Inst. of Tech., Cambridge, USA. Dept. of Applied Biological Sciences). Apr 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700808/JAW.

Hard copies are available from Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.

In Food Irradiation Newsletter. Vol. 11, No. 1.

Following extensive chemical analyses and animal experimentation, which have shown that irradiated foods are safe, the Chinese researchers have carried out 8 well controlled experiments involving human volunteers consuming irradiated foods for 7 to 15 weeks periods. There were 17 to 70 test subjects in each experiment, and the total number of subjects was 439. Each clinical test in all the experiments failed to discern any significant difference between the control groups and the test groups consuming irradiated foods. Seven of the eight experiments involved investigations of chromosomal aberrations in a total of 382 individuals. Some of these experiments included freshly irradiated wheat in the diet. No significant difference between the number of chromosomal aberrations in the control groups and the test groups could be discerned in any of the seven experiments, either when evaluated individually or when all seven were pooled together. When all the experiments were pooled together, the average number of polyploidy at the beginning of the tests, before the exposure to irradiated foods, was 0.22% and 0.36% for the control and experimental groups respectively and after the exposure to the irradiated foods the polyploidy was 0.29% and 0.26% in the control and in the experimental groups respectively. The standard deviation of the mean value, 0.28%, was 0.23%. The relative increase in polyploidy in the control group, 0.29%-0.22%=+0.07%, and the relative decrease in the polyploidy in the experimental group, 0.26%-0.36%=-0.10% is statistically insignificant. In separate experiments it was shown that irradiation significantly reduces carcinogenic nitrosamines found in many foods confirming similar observation at U.S. Army Natick Laboratories in the 70's. (author). 51 refs, 2 tabs.

12648 (INIS-mf—11059-Vol.11-No.1, pp 48) **Preservation of potato by irradiation.** Nouami, A.; Boussaha, A.; Azzout, B. (Haut Commissariat a la Recherche, Algiers, Algeria. Centre d'Etudes Nucleaires et Solaires). Apr 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700808/JAW.

Hard copies are available from Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.

In Food Irradiation Newsletter. Vol. 11, No. 1.

12649 (INIS-mf—11059-Vol.11-No.1, pp 49) **Application of gamma irradiation for the extended commercial storage of potatoes.** Nouami, A.; Boussaha, A.; Azzout, B. (Haut Commissariat a la Recherche, Algiers, Algeria. Centre d'Etudes Nucleaires et Solaires). Apr 1987. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88700808/JAW.

Hard copies are available from Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.

In Food Irradiation Newsletter. Vol. 11, No. 1.

12650 (INIS-mf—11082) **Influence of storage period of gamma-irradiated seeds on the catalase activity and the synthesis of alpha-amilase in maize.** Velichkov, D.; Antonov, M.; Spasov, S. (International Atomic Energy Agency, Vienna (Austria)). Oct 1983. 5p. (In Bulgarian). (CONF-8310450—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700882/JAW.

From Symposium on current theoretical and applied aspects of plant ecology; Plovdiv, Bulgaria (10 Oct 1983).

It was established that irradiation of the maize hybrid Knezha 2L-611 seeds with the dose 5 Gy showed the most constant and the best expressed stimulation effect. The activity of catalase and synthesis of alpha-amylase showed that the most convenient time for sowing of seeds irradiated with 5 Gy was 2 days after the treatment.

12651 (INIS-mf—11083) **Changes in the UV radiosensitivity of plant peroxidase caused by metal ions.** Bakyrdzhieva, N.T. (International Atomic Energy Agency, Vienna (Austria)). Oct 1983. 9p. (In Bulgarian). (CONF-8310450—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700883/JAW.

From Symposium on current theoretical and applied aspects of plant ecology; Plovdiv, Bulgaria (10 Oct 1983).

The pea peroxidase protein is sensitive to direct UV-irradiation and reacts by changes in its functionality. A well expressed inhibition of peroxidase activity is observed. The experimental data show that some metal ions (Li, Cu, Zn, Mn) may play the role of photosensitizers and after interacting with the enzime protein constitute a factor regulating light-depending changes in peroxidase activity.

12652 (INIS-mf—11084, pp 40) **Standardisation of /sup 111I/n-labelled polymer beads as tracer, and the type of meal in the evaluation of gastric emptying and colon transit rates in normal beagle dogs.** Dormehl, I.C.; Pilloy, W.; Du Plessis, M.; Maree, M. (Pretoria Univ., South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12653 (INIS-mf—11084, pp 40) **Effects of fenoterol on lung clearance.** Sweetlove, M.A.; Pretorius, H.; Van Rensburg, A.J.; Viljoen, H.; Loetter, M.G.; Weich, D.J.V.; Minnaar, P.C. (University of the Orange Free State, Bloemfontein, South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12654 (INIS-mf—11085(no.39)) **Insect and Pest Control Section newsletter and information circular on radiation techniques and their application to insect pests. No. 39.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Jul 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701078/JAW.

The Information Circular presents preliminary reports of research and development activities in the application of nuclear energy for entomological problems and related aspects. Radiation

sterilization and isotope-aided studies are stressed, however, articles relating to practical pest control or eradication are also within the scope of the Information Circular.

12655 (INIS-mf—11086/86(no.2)) Activities of the Entomology Unit. Report No. 2, 1986. (International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy)). Dec 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701079/JAW.

This semi-annual report describes the activities carried out by the staff of the Entomology Unit at the Agency's Laboratories, Seibersdorf, between 1 July and 31 December 1986. This report includes preliminary results of research not sufficiently complete to justify general release. Such findings, when adequately confirmed, will be released through established channels. Figs and tabs.

12656 (INIS-mf—11086/87(no.1)) Activities of the Entomology Unit. Report No. 1, 1987. (International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy)). Jun 1987. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701080/JAW.

This semi-annual report describes the activities carried out by the staff of the Entomology Unit at the Agency's Laboratories, Seibersdorf, between 1 January and 30 June 1987. This report includes preliminary results of research not sufficiently complete to justify general release. Such findings, when adequately confirmed will be released through established channels. Figs and tabs.

12657 (ISH—109) Thermoluminescence and chemiluminescence measurement as routine screening method for identification of irradiated spices. Studies to establish limiting values for differentiation of irradiated and non-irradiated samples. Heide, L.; Albrich, S.; Mentele, E.; Boegl, W. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Apr 1987. 346p. (In German). Bundesgesundheitsamt, Neuherberg, Germany, F.R. Inst. fuer Strahlenhygiene.

The reported experiments with non-irradiated and γ-irradiated spices of different origin were conducted to determine the variation in chemiluminescence and thermoluminescence intensity for each individual spice. 29 spices from 7 to 10 different manufacturers have been examined, taking into account the influence of storage time. In order to evaluate the methods, the results are represented in diagrams and tables enabling light emission limits to be given for differentiation between irradiated and non-irradiated samples. The final section of this report contains a conclusive evaluation of the present state of chemiluminescence and thermoluminescence analysis for the detection of irradiated spices.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

REFER ALSO TO CITATION(S) 12503

5601 Radiation Effects

REFER ALSO TO CITATION(S) 12611, 12725

12658 (CONF-8607355—1) Criteria for the selection of nuclides for radioimmunotherapy. Adelstein, S.J.; Kassis, A.I. (Harvard Medical School, Boston, MA (USA)). 1986. Contract FG02-86ER60460. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002584/JAW.

From Symposium on radiolabeled monoclonal antibodies for imaging and therapy: potential, problems, and prospects; Pascoli, Italy (20 Jul 1986).

This report describes many factors that need to be considered if radioimmunotherapy is to become a commonplace reality. For beta-emitting radionuclides, two physical features of importance are half-life and energy, with the latter determining the range. These features must be matched to the pharmacokinetics of the carrier and the distribution of the radionuclide, both macroscopically and microscopically. Alpha-particle emitters could be considered for cells that are readily accessible to the labeled antibody and for populations that uniformly and constantly display the targeted antigen or idiotype, e.g., trafficking cells such as T or B lymphocytes. For cells that concentrate the radioactive label, the use of low-energy electrons should be examined. If the radionuclide is translocated to the nucleus, the Auger effect can be particularly lethal because of the high LET-like biological response. 15 refs., 3 figs., 2 tabs.

12659 (CONF-8703207—1) Modelling approaches for estimating derived intervention levels in foods. Hoffman, F.O. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87013881/JAW.

From Scientific seminar on foodstuff intervention levels following a nuclear accident; Luxembourg, Luxembourg (27 Mar 1987).

This paper presents an overview of the procedures and steps required when using mathematical models to simulate environmental systems to establish derived intervention levels (DILs) in foods. After determining an acceptable level of risk, the most important model parameters for calculating DILs are risk conversion factors, dose conversion factors for a unit ingestion of a given radionuclide, consumption rates of different food types, and the ratio of the peak activity in food to the time-integrated concentration in food (annual or lifetime). Terrestrial and aquatic foodchain transport models are only needed to establish secondary DILs for the deposition on land or the concentration of a radionuclide in animal feed and fodder. The derivation of the Protective Action Guides (PAGs) is reviewed, and values are given for both emergency and preventive PAGs for I-131, Sr-89, Sr-90, Cs-134, and Cs-137. Explicit estimates of uncertainty are also recommended as attempts are made to produce model predictions that are realistic rather than conservatively biased. Examples from an international model validation exercise (BIOMOVS) that is using data from the Chernobyl accident are also provided. 10 refs., 3 figs., 4 tabs.

12660 (CONF-8705217—1) Radioactivity in persons exposed to fallout from the Chernobyl reactor accident. Schlenker, R.A.; Oltman, B.G.; Lucas, H.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003119/JAW.

From 21. annual conference on trace substances in environmental health; St. Louis, MO, USA (25 May 1987).

Measurements of fallout radioactivity were made in the thyroid region, abdomen, whole body, or urine of 96 persons who were in eastern Europe at the time of the Chernobyl reactor accident or who went there shortly afterward. The most frequently encountered radionuclides were ^{131}I, sup 134,137/Cs, and ^{103}Ru/^{103}Rh. The median ^{131}I activity in the thyroids of 42 subjects in whom radioiodine was detected and who were in Europe when the accident began was projected as 42 nCi the day the accident began. The median total body activity of ^{134}Cs in 40 subjects in which it was detected was 1.7 nCi upon arrival in the US. For 51 subjects with detectable ^{137}Cs burdens, the total body activity was 4.6 nCi. The risk of fatal thyroid cancer is less than 3×10^{-6} for nearly all subjects in this series. The risk of fatal cancer from /sup 134,137/Cs for subjects with cesium exposures similar to the ones observed by us, but who remained in Europe, is estimated as 1.4×10^{-6} to 4.2×10^{-6} with 95% of the risk attributable to ^{137}Cs. 5 refs., 4 tabs.

12661 (CONF-8705217—2) Correlates of long-term alkaline earth retention. Stebbings, J.H.; Schlenker, R.A.; Keane, A.T.; Kotek, T.J.; Jansen, A.J. (Argonne National Lab., IL (USA); Illinois Univ., Chicago (USA). Coll. of Medicine). 1987. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003127/JAW.

From 21. annual conference on trace substances in environmental health; St. Louis, MO, USA (25 May 1987).

Sequential measurements of radium body burdens of adults with occupational or iatrogenic exposure to radium make possible analyses of variables relating to radium, and thus alkaline earth, excretion. Data on 63 subjects from several occupational cohorts, plus iatrogenic subjects, were analyzed to determine effects of sex, age

at exposure, exposure duration, and age at measurement upon the coefficient of elimination (λ). While 12 women exposed at age 17 to 18 had λ's significantly lower than those exposed at ages 15 to 16 or 21 to 26, λ showed no overall trend with age at exposure among females. Higher radium burdens associated with bone damage are associated with decreased λ's, but neither exposure duration nor age at measurement correlated significantly with λ. The 12 males had λ's about 60% of those for females after adjustment for retention time. The male λ's were lower the earlier the age at exposure. Effects of personal habits were studied in a homogeneous cohort of female Illinois dial painters with relatively uniform ages at first employment. The most powerful predictor of radium loss was the number of cups of coffee and tea consumed per day. Coffee/tea consumption explained ~35% of the variance in λ, the effect persisting after deletion of smokers and subjects with x-ray evidence of bone damage. 15 refs., 3 figs., 1 tab.

12662 **(CONF-8710184—5) Building the basis for a comprehensive radiation protection program for a multi-program laboratory.** Copenhaver, E.D. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88001741/JAW.

From 11. annual Training Resources and Data Exchanges (TRADE) conference; Atlanta, GA, USA (26 Oct 1987).

An explicit, workplace-specific training has been developed, implemented, and documented for all radiation workers. In addition to the radiation worker personnel located at reactors, accelerators, radiochemical laboratories, and waste treatment areas, we have trained other personnel who work in areas where a lesser potential for radiological/chemical exposure exists. These workforces include construction crews, site restoration crews, contracted special services such as scoping and site characterization teams, and short-term visitors. We are developing a comprehensive, integrated approach to radiation protection training suited for a multi-purpose research laboratory. 9 refs., 1 fig., 1 tab.

12663 **(DOE/ER/60539—2) Multiple oncogene activation in a radiation carcinogenesis model.** Garte, S.J.; Sawey, M.J.; Burns, F.J.; Felber, M.; Ashkenazi-Kimmel, T. (New York Univ., NY (USA). Inst. of Environmental Medicine). 1987. Contract FG02-87ER60539. 4p. (CONF-870701—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002636/JAW.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

There is evidence from animal systems to suggest that certain oncogenes may be activated by the direct action of the initiating carcinogen. Consistent activation by a point mutation of a single member of the ras oncogene family in different tumors produced by a single agent has been demonstrated. In contrast the c-myc and other oncogenes have been shown to be activated by a process involving chromosomal translocations, enhanced expression, and/or gene amplification. We have examined a panel of 12 late stage rat skin tumors for activation of oncogenes from the ras and myc complementation groups. These tumors were four squamous cell carcinomas, three poorly differentiated carcinomas (clear cell), one each of basal cell carcinoma, sebaceous carcinoma, sarcoma, fibroma, and mixed (largely squamous) histology carcinoma. The positive tumor DNAs were from three poorly differentiated clear cell carcinomas, a sebaceous carcinoma, a squamous cell carcinoma, and a sarcoma. DNA from one of the primary transfectants was positive in a second round of transfection. The transformed phenotype of the transfectants was confirmed by anchorage independent growth and tumorigenicity in nude mice. Southern blot analysis of DNA from primary and secondary transfectants, as well as from nude mouse tumors arising after injection of transfectant cells revealed the presence of rat derived restriction fragments homologous to the K-ras oncogene against the mouse background. Similar experiments using N- and H-ras probes, revealed only the endogenous mouse fragments in transfectant DNA. 11 refs., 1 tab.

12664 **(DOE/EV/01013—H1) Radon Research Program, FY-1987.** (USDOE Assistant Secretary for Environment, Washington, DC. Office of Health and Environmental Research; Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Nov 1987. Contract AC04-76EV01013. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002633/JAW.

This program summary documents the radon-related research activities supported by the Office of Health and Environmental Research (OHER) during FY-1987. It includes scientific background, research program goals, and summaries in the availability and transport of radon in the environment, and into and within homes. Also included are summaries of physical-chemical interactions of radon progeny in ambient air and the lung cancer risk to the public from exposure to radon progeny. The main goal is to reduce uncertainties in evaluating health risks to people from inhaling radon and its progeny in indoor air. (CS)

12665 **(INIS-mf—11084, pp 43) Risks of diagnostic x-rays during early pregnancy.** Savage, D.J.; Hartkamp, A. (Verwoerd, H.F. Hospital, Pretoria, South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

12666 **(KAERC—403/86) Investigation on the radiation modificated insulators based on polyethylene.** Cho Sang Gyu; Li In Son; Chong Yong Mu. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). 10 Oct 1986. 8p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701392/JAW.

By examining the effect of silicon gum and some additions mixed with high pressure polyethylene on the radiation cross-linking it was shown, that mechanical and electrical properties of plastic materials mixed with silicon gum has been greatly improved. Tin-organic compound itself does not give effect on the process of the radiation cross-linking, but it was established, that, when used with another stabilizer, it was protected from thermal oxidation.

12667 **(NCRP—93) Ionizing radiation exposure of the population of the United States.** (National Council on Radiation Protection and Measurements, Bethesda, MD (USA)). 1 Sep 1987. 96p. National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814. Order Number TI88900254/JAW.

As accurate an assessment as possible was made of the overall exposure of the US population from all sources of ionizing radiation. These sources were categorized according to the origin of the exposure: natural radiation, occupational, the nuclear fuel cycle, consumer products, miscellaneous environmental sources connected with human activities, and medical diagnosis and therapy. This report provides a comprehensive account of the exposure of members of the US public to all sources of ionizing radiation. 77 refs., 1 fig., 21 tabs.

12668 **(NUREG/CR—4704-Vol.1) Relative biological effectiveness (RBE) of fission neutrons and gamma rays at occupational exposure levels: Volume 1, Studies on the genetic effects in mice of 60 equal once-weekly exposures to fission neutrons and gamma rays.** Grahn, D.; Carnes, B.A. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 71p. (ANL—86-33-Vol.1). NTIS, PC A04/MF A01 - GPO. Order Number TI88003681/JAW.

The relative biological effectiveness (RBE) values for low doses of fission neutrons compared to ^{60}Co gamma rays were determined with four separate assessments of genetic damage induced in young hybrid male mice. Both radiations were delivered at low dose levels over about one-half the adult lifetime as 60 once-weekly exposures. Genetic damage assessed included both transient and residual injury. The latter is more critical, as residual genetic injury can be transmitted to subsequent generations long after the radi-

ation exposures have ceased. Assays were performed periodically during the 60-week exposure period and at 10 or more weeks after the irradiations had terminated. RBE values, with few exceptions, ranged between 5 and 15 for transient injury and between 25 and 50 for different types of residual genetic injury. The most important form of residual genetic damage in this study was the balanced reciprocal chromosome translocation. These translocations continue to be transmitted throughout reproductive life and can lead to reduced fertility and increased prenatal mortality. The best estimate of the RBE value for translocations was 45 +- 10. Implications and recommendations with regard to the neutron quality factor will be presented conjointly with the findings from the data obtained in this same project on life shortening and on the risks of incidence or death from neoplastic disease. 64 refs., 23 tabs.

12669 **(NUREG/CR—4704-Vol.2) Relative Biological Effectiveness (RBE) of fission neutrons and gamma rays at occupational exposure levels: Volume 2, Studies on the effects of 60 equal once-weekly exposures to fission neutrons and gamma rays on survival of mice.** Thomson, J.F.; Grahn, D. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 42p. (ANL—86-33-Vol.2). NTIS, PC A03/MF A01 - GPO. Order Number TI88003950/JAW.

A total of 6316 mice were exposed to 60 once-weekly doses of 0.85 MeV fission neutrons or ^{60}Co gamma rays and observed until they died. An additional 1404 mice were entered into the experiment and followed for part of their lifetimes; a few of these mice were lost accidentally, but most were removed for genetic testing. The mean aftersurvival (MAS) times showed dose-response curves for both neutron and gamma-ray exposures to be linear over all doses except the highest neutron dose. The relative biological effectiveness (RBE) value for neutrons, calculated as the ratio of the linear slopes of the dose-response curves for MAS times, was about 20 for both males and females. Essentially the same value was obtained by other analyses of the data. This RBE value of 20 is specific for deaths from all causes after 60 once-weekly exposures to 0.85 MeV fission neutrons, with once-weekly ^{60}Co gamma-ray exposures as the reference radiation. The value for the RBE will probably be different for some, but not all, of the other end points (i.e., specific causes of death, especially tumors). 21 refs., 6 figs., 6 tabs.

12670 **(NUREG/CR—4986) Radiation dose estimates and hazard evaluations for inhaled airborne radionuclides: Final report.** Mewhinney, J.A. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Sep 1987. 102p. NTIS, PC A06 - GPO. Order Number TI88900067/JAW.

The project objective was to conduct confirmatory research on physical chemical characteristics of aerosols produced during manufacture of mixed plutonium and uranium oxide nuclear fuel, to determine the radiation dose distribution in tissues of animals after inhalation exposure to representative aerosols of these materials, and to provide estimates of the relationship of radiation dose and biological response in animals after such inhalation exposure. The first chapter summarizes the physical chemical characterization of samples of aerosols collected from gloveboxes at industrial facilities during normal operations. This chapter provides insights into key aerosol characteristics which are of potential importance in determining the biological fate of specific radionuclides contained in the particulates that would be inhaled by humans following accidental release. The second chapter describes the spatial and temporal distribution of radiation dose in tissues of three species of animals exposed to representative aerosols collected from the industrial facilities. These inhalation studies provide a basis for comparison of the influence of physical chemical form of the inhaled particulates and the variability among species of animal in the radiation dose to tissue. The third chapter details to relationship between radiation dose and biological response in rats exposed to two aerosol forms each at three levels of initial pulmonary burden. This study, conducted over the lifespan of the rats and assuming results to be applicable to humans, indicates that the hazard to health due to inhalation of these industrial aerosols is not different than previously determined for laboratory produced aerosol of PuO_2. Each chapter is processed separately for the data base.

12671 (NUREG/CR—4986, pp 7-28) **Summary of the physical chemical analyses of mixed oxide nuclear fuel as they might influence biological behavior and internal dose.** Eidson, A.F.; Mewhinney, J.A. Sep 1987. NTIS, PC A06 - GPO. Order Number TI88900067/JAW.

In Radiation dose estimates and hazard evaluations for inhaled airborne radionuclides: Final report.

Twelve representative materials that might be accidentally released during the fabrication of mixed-oxide nuclear fuel pellets were studied using x-ray diffraction, infrared spectroscopy, energy dispersive x-ray fluorescence, alpha spectroscopy and in vitro dissolution methods. The results are related to a postulated exposure accident and to inhalation experiments using laboratory animals. 19 refs., 5 figs., 19 tabs.

12672 (NUREG/CR—4986, pp 29-59) **Distribution of radiation dose after inhalation of aerosols derived from fabrication of mixed oxide nuclear fuels.** Mewhinney, J.A.; Eidson, A.F.; Boecker, B.B. Sep 1987. NTIS, PC A06 - GPO. Order Number TI88900067/JAW.

In Radiation dose estimates and hazard evaluations for inhaled airborne radionuclides: Final report.

The spatial and temporal distribution of radiation dose to tissues of three species of animals was defined following inhalation of one of three particulate materials representative of aerosols produced in the manufacture of mixed uranium and plutonium oxide nuclear fuel. Rats, dogs and monkeys received a single inhalation exposure to one of three materials and groups of five rats, two dogs or one monkey were sacrificed at selected times up to four years after exposure. The three aerosol materials used were a mixture of UO_2 and PuO_2 powders treated at 750°C, a solid solution of $(U,Pu)O_2$ treated at 1750°C, and PuO_2 treated at 850°C. The data defining retention, distribution and excretion of plutonium and americium present in these materials were compared using a biokinetic model to highlight similarities and differences. Lung retention of the plutonium component of these particulates for any one of the three species was not different. In contrast, lung retention of the plutonium component was dependent on the species of animal, apparently due to differences in the rate of mucociliary clearance. The synthesis of information from each aerosol and each species studied indicated that radiation dose distribution in tissue was essentially the same as that measured in animals exposed by inhalation to laboratory-produced aerosols of PuO_2. There was no indication that the hazard to humans exposed to these industrial materials would be appreciably different than has been estimated for laboratory-produced aerosols of PuO_2. 28 refs., 12 figs., 5 tabs.

12673 (NUREG/CR—4986, pp 61-89) **Dose-response study in F344 rats exposed to $(U,Pu)O_2$ or PuO_2.** Mewhinney, J.A.; Eidson, A.F.; Hahn, F.F.; Scott, B.R.; Seiler, F.A.; Boecker, B.B. Sep 1987. NTIS, PC A06 - GPO. Order Number TI88900067/JAW.

In Radiation dose estimates and hazard evaluations for inhaled airborne radionuclides: Final report.

The relationship of radiation dose to lung and the biological effect observed was investigated following inhalation of two types of plutonium-containing particulate materials in rats. Bulk powder samples of the two materials were obtained from within gloveboxes used in the routine manufacture of mixed plutonium and uranium oxide nuclear fuel. The materials were a solid solution of uranium and plutonium treated at 1750°C and a PuO_2 feedstock. Groups of rats received a single inhalation exposure to a material to achieve one of three levels of initial pulmonary burden. Rats were maintained for their lifespan to observe the biological effects produced. These effects were observed in the lungs of rats exposed to either type of particle. The same types of lung cancer were produced by both particulate materials. The incidences of cancers were also similar at comparable levels of initial pulmonary burden for the two materials. The crude incidence of lung cancers for rats exposed to these materials was not different than those reported for similar studies that used laboratory-produced aerosols of PuO_2. Using a linear dose-effect model, the relative risk of lung cancer for rats exposed to these industrial materials was 2.3 +- 1.0 (SE) at a lung dose of 100 rad. The doubling dose for lung cancers was 78 +- 63 rad to lung to median life span. 21 refs., 9 figs., 10 tabs.

12674 (NUREG/CR—5025) Experimental studies of the early effects of inhaled beta-emitting radionuclides for nuclear accident risk assessment: Phase 2 report. Scott, B.R.; Hahn, F.F.; Newton, G.J.; Snipes, M.B.; Damon, E.G.; Mauderly, J.L.; Boecker, B.B.; Gray, D.H. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Nov 1987. Contract AC04-76EV01013. 115p. NTIS, PC A06/MF A01 - GPO. Order Number TI88003506/JAW.

This report summarizes a series of experiments concerning the effect of linear energy transfer and temporal radiation dose pattern to the lung from inhaled beta-emitting radionuclides. The results were used to test the validity of a hazard-function mathematical model for predicting death from radiation pneumonitis. Both morbidity and mortality within 18 months after exposure were examined in rats exposed to beta-emitting radionuclides, giving brief or protracted irradiation of the lung or having weak or strong beta emissions. Protraction of the radiation dose to the lung from a half-time in the lung of less than three days to a half-time with a long-term component of about 150 days has a sparing effect. The median lethal dose for the protracted irradiation is about 1.7 times the median lethal dose for the brief irradiation. Low energy beta emissions from ^{147}Pm have a similar effectiveness in producing lethal injury as high energy beta emissions from ^{90}Sr. Changes in three parameters of morbidity were measured: body weight, hematology and pulmonary function; only changes in pulmonary function correlated well with pulmonary radiation injury. The doses of radiation required to produce impaired function, however, were not significantly different from those that produced death. The hazard-function model for predicting death from radiation pneumonitis, which was developed from previously obtained data for inhalation exposures of dogs to beta-emitting radionuclides, adequately predicted the median lethal doses for rats receiving one of several different beta dose rate patterns to the lung, thus strengthening the validity of the mathematical model. 23 refs., 41 figs., 12 tabs.

12675 (PB—88-106372/XAB) Ecological and nonhuman biological effects of solar UV-B radiation. Worrest, R.C. (Oregon State Univ., Corvallis (USA). Dept. of General Science). 1984. 19p. NTIS, PC A03/MF A01.

Recent studies regarding the impact of UV-B radiation upon ecological and nonhuman biological systems is the subject of the report. For years scientists and laymen alike have causally noted the impact of solar ultraviolet radiation upon the nonhuman component of the biosphere. Stratospheric ozone functions effectively as an ultraviolet screen by filtering out solar radiation in the 220-320 nm waveband as it penetrates through the atmosphere, thus allowing only small amounts of the longer wavelengths of radiation in the waveband to leak through to the surface of the earth. Although this radiation (UV-B radiation, 290-320 nm) comprises only a small fraction (lesser tha 1%) of the total solar spectrum, it can have a major impact on biological systems due to its actinic nature. Many organic molecules, most notably DNA, absorb UV-B radiation which can initiate photochemical reactions. It is life's ability, or lack thereof, to cope with enhanced levels of solar UV-B radiation that has generated concern over the potential depletion of stratospheric ozone.

12676 (PNL-SA—14875) An analytic model for ionization distributions produced in nanometer sites by protons. Wilson, W.E.; Paretzke, H.G. (Pacific Northwest Lab., Richland, WA (USA); Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Sep 1987. Contract AC06-76RL01830. 10p. (CONF-871020—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003943/JAW.

From 6. symposium on neutron dosimetry; Neuherberg, F.R. Germany (12 Oct 1987).

A concise mathematical model is presented for the microdosimetric ionization distributions produced in sub-cellular volumes by energetic protons of 0.3 to 20 MeV. The model is based on the results of extensive Monte Carlo computer simulations of high-LET charged particle tracks and can be used to estimate, with only a modest computing effort, straggling and delta-ray transport effects in the nanometer dosimetry of high-LET radiations. 6 refs.

12677 (PNL-SA—15004) Proceedings of the Department of Energy workshop on beta measurements. Swinth, K.L.; Vallario, E.J. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1987. Contract AC06-76RL01830. 270p. (CONF-860149—). NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88004068/JAW.

From Department of Energy workshop on beta measurements; Albuquerque, NM, USA (23 Jan 1986).

Participants discussed current practices, efforts to upgrade the quality of beta measurements, and initiatives necessary to improve the measurement and control of beta doses. This proceedings includes papers presented at the workshop, transcripts of panel and open discussions, and documentation of question and answer sessions. The information exchange resulting from this meeting is expected to provide a clearer focus on the problems of beta measurements.

12678 (PNL-SA—15152) Experience with the application of radiation protection standards: A driving force. Selby, J.M.; Swinth, K.L.; Vallario, E.J. (Pacific Northwest Lab., Richland, WA (USA); USDOE, Washington, DC). Sep 1987. Contract AC06-76RL01830. 13p. (CONF-8709104—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002083/JAW.

From ANS topical conference on population exposure from nuclear fuel cycle; Oak Ridge, TN, USA (15 Sep 1987).

This paper identifies the driving forces for the development of new standards within the radiation protection areas, characterizes the process of developing such guidance, discusses problems with the application of guidance and discusses experience in applying recommendations and standards. Efforts to improve performance in health physics measurements will also be described including methods to determine the feasibility and applicability of standards. 15 refs., 1 fig., 3 tabs.

12679 (SAND—87-2814C) Comparison of environmental TLD [thermoluminescent dosimeter] results obtained using glow curve deconvolution and region of interest analysis. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-871183—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002410/JAW.

From Harshaw-Filtrol TLD users meeting; Houston, TX, USA (15 Nov 1987).

We tested a Harshaw Model 4000 TLD Reader in the Sandia Environmental TLD Program. An extra set of LiF TLD-700 chips were prepared for each field location and calibration level. At the end of quarter one, half of the TLDs were read on the Model 4000 and the other half were read on our standard Harshaw Model 2000. This presentation compares the results of the two systems. The Model 4000 results are reported for two regions of interest and for background subtraction using Harshaw Glow Curve Deconvolution Software.

12680 (UCRL—94589) Passive dosimeters other than film and TLDs [thermoluminescent dosimeter]. Hankins, D.E. (Lawrence Livermore National Lab., CA (USA)). 15 May 1986. Contract W-7405-ENG-48. 16p. (CONF-8606350—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87009579/JAW.

From Summer school on external dosimetry; Pittsburgh, PA, USA (23 Jun 1986).

This presentation will describe CR-39 plastic as a personnel neutron dosimeter. Recent research at LLNL and elsewhere has resulted in the development of a dosimetry system that is superior to any personnel neutron dosimeter previously available. The author describes the features of the dosimetry system and the new etching procedures and techniques in detail. Most of the research was done at the LLNL and has been supported as a part of the DOE Neutron Dosimetry Upgrade Program. 10 refs., 4 figs., 1 tab.

12681 **(UCRL—96541) Atmospheric releases from severe nuclear accidents: Environmental transport and pathways to man: Modelling of radiation doses to man from Chernobyl releases.** Anspaugh, L.R.; Goldman, M.; Catlin, R.J. (Lawrence Livermore National Lab., CA (USA); California Univ., Davis (USA); Electric Power Research Inst., Palo Alto, CA (USA)). 1987. Contract W-7405-ENG-48. 9p. (CONF-870911—3; IAEA-CN—48/274). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003951/JAW.

From International conference on the technical and economic performance of nuclear power; Vienna, Austria (28 Sep 1987).

The Chernobyl accident released a large amount of highly fractionated radioactive debris, including approximately 89 PBq of ^{137}Cs. We calculated the resulting collective dose commitment to the Northern Hemisphere via the pathways of external exposure and ingestion of radionuclides withd food. We developed a rural/urban model of external dose and we used the PATHWAY model for ingestion. The results are a collective dose commitment of 630,000 person-Gy over the first year and 1,200,000 person-Gy over 50 years. 13 refs., 1 tab.

12682 **(UCRL—96542) Projected global health impacts from severe nuclear accidents: Conversion of projected doses to risks on a global scale: Experience from Chernobyl releases.** Catlin, R.J.; Goldman, M.; Anspaugh, L.R. (Electric Power Research Inst., Palo Alto, CA (USA); California Univ., Davis (USA); Lawrence Livermore National Lab., CA (USA)). 1987. Contract W-7405-ENG-48. 21p. (CONF-870911—2; IAEA-CN—48/273). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003952/JAW.

From International conference on the technical and economic performance of nuclear power; Vienna, Austria (28 Sep 1987).

Best estimates of possible additional health effects were projected for the Northern Hemisphere: (1) over the next 50 years, up to 28 thousand radiation-induced fatal cancers, compared to an expected 600 million cancer deaths from natural or spontaneous causes; (2) over the next year, up to 700 additional cases of severe mental retardation, compared to a normal expectation of 340 thousand cases; and (3) in the first generation, up to 1.9 thousand radiation-induced genetic disorders, compared to 180 million naturally-occurring cases. The possibility of zero health effects at very low doses and dose rates cannot be excluded. Due to the very large numbers of naturally-occurring health effects, it is unlikely that any additional health effects will be demonstrable except, perhaps, for the more highly exposed population in the immediate vicinity of Chernobyl. 13 refs., 4 figs., 6 tabs.

12683 **Comparison of estimates of systemic Pu from urinary excretion with estimates from post-mortem tissue analysis.** Kathren, R.L.; Heid, K.R.; Swint, M.J. (Pacific Northwest Lab., Richland, WA). *Health Physics;* 53: No. 5, 487-493(Nov 1987).

Urinalysis data for 17 individuals with known exposure to Pu were supplied to six laboratories, each of which made an estimate of systemic deposition. In general, the evaluation was done with the Langham model or one of its derivatives, and the values obtained by the laboratories for any single case were typically within a factor of two of the mean for all laboratories. The estimates made from urinalysis data typically were several-fold greater than those made from autopsy data. The results indicate that estimates based on urinary excretion overestimate systemic deposition and tend to confirm previous observations that the Langham equation underestimates urinary excretion.

12684 **7,12-dimethylbenz[a]anthracene plus near-u.v. light initiates DNA damage and repair in Chinese hamster cells.** Utsumi, H.; Kitani, H.; Chinmei Changliu; Elkind, M.M. (Colorado State Univ., Fort Collins, USA. Dept. of Radiology and Radiation Biology; Argonne National Lab., IL, USA; Colorado State Univ., Fort Collins, USA. Dept. of Radiology and Radiation Biology; Argonne National Lab., IL, USA). *Carcinogenesis;* 8: No. 10, 1439-1444(Oct 1987).

Earlier results on the photodynamic action of several carcinogenic polycyclic aromatic hydrocarbons, and particularly 7,12-dimethylbenz[a]anthracene (DMBA), have been extended to determine if DMBA + near-u.v. light produces damage to DNA. DMBA by itself introduces relatively few breaks into genomic DNA. The addition of near-u.v. light, however, inserts large numbers of single-strand breaks in a dose-dependent way. Incubation following exposure initially results in the rapid repair of these breaks. A primary role for DNA damage in photodynamic cell killing is not supported by other observations, however. Thus, a starting point for mutagenic and carcinogenic action in the absence of light is suggested although activation of DMBA by a P-450 system does not appear to be a prerequisite of DMBA - DNA association. Still, DNA as such may not be the initial or the primary target for light-induced cell killing. In addition to interacting with DNA, DMBA is sequestered by membranes, suggesting that killing results from an oxygen-dependent release of catabolic enzymes. These enzymes, which may come from lysosomes, degrade DNA but concomitantly release surface-attached cells into the medium.

12685 **Daily intake of /sup 234,235,238/U, /sup 228,230,232/Th and /sup 226,228/Ra by New York City residents.** Fisenne, I.M.; Perry, P.M.; Decker, K.M.; Keller, H.W. (Dept. of Energy, New York, NY). *Health Physics;* 53: No. 4, 357-363(Oct 1987).

The daily intake of long-lived alpha-emitting members of the U, Th and Ac series by New York City residents has been estimated from measurements of diet, water and air samples. The total daily intakes from inhalation, food and water consumption in mBq are 18 (^{234}U), 0.7 (^{235}U), 16 (^{238}U), 6 (^{230}Th), 4 (^{232}Th) and 52 (^{226}Ra). From this, we infer that the total daily intakes of ^{228}Th and ^{228}Ra are 4 and 35 mBq, respectively.

12686 **Inhalation deposition and retention patterns of a U-Pu chain aggregate aerosol.** Briant, J.K.; Sanders, C.L. (Pacific Northwest Lab., Richland, WA). *Health Physics;* 53: No. 4, 365-375(Oct 1987).

Chain aggregate aerosol particles are normally formed during many high-temperature combustion and vaporization processes. The shape of chain aggregate aerosol particles could have an effect on the pattern of inhalation deposition and retention of the particles in the respiratory tract. A chain aggregate aerosol of nuclear reactor fuel could be present as an inhalation hazard if it were released to the atmosphere after a meltdown, core-disruptive accident. Rats were exposed to a chain aggregate U-Pu aerosol made by laser vaporization of mixed-oxide, breeder reactor fuel (20% plutonium dioxide and 80% uranium dioxide), then sacrificed to measure the clearance and retention of the fuel aerosol particles. Deposition of the 0.7-micron (activity median aerodynamic equivalent diameter) aerosol particles resulted in an average initial lung burden of 4140 Bq alpha activity. The chain aggregate particle shape was not a major factor in the total deposition; however, it may have influenced the regional distribution of the activity deposited. Retention of the particles in the upper airways of the tracheobronchial tree was on the order of 1% of the concurrent lung burden, which is consistent with recent data of other investigations. This study indicates that insoluble chain aggregate particles are retained in the tracheobronchial airways to a degree similar to simple spherically shaped particles of equivalent volume diameter.

12687 **Dose-incidence relationships for exencephalia, anophthalmia and prenatal mortality in mouse embryos irradiated with fission neutrons or 250 kV X-rays.** Friedberg, W.; Faulkner, D.N.; Neas, B.R.; Hanneman, G.D.; Darden, E.B. Jr.; Deal, R.B. Jr.; Parker, D.E. (Federal Aviation Administration, Oklahoma City, OK, USA. Civil Aeromedical Inst.; Oak Ridge National Lab., TN, USA; Oklahoma Univ., Oklahoma City, USA. Health Sciences Center). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* 52: No. 2, 223-236(Aug 1987).

Groups of pregnant mice were irradiated at selected times between 10.00 hours on gestation day 7 and 16.00 hours on day 8. Each group received 0.39 Gy of neutrons or 1.60 Gy of X-rays, or was sham irradiated. We identified a period of high susceptibility of the embryos to radiation-induced exencephalia, anophthalmia and prenatal mortality early in gestation day 8. Dose-incidence relationships in this period were investigated with 0.19-0.48 Gy of neutrons and with 0.40-2.00 Gy of X-rays.

12688 **Induction of direct and indirect single-strand breaks in human cell DNA by far- and near-ultraviolet radiations: action spectrum and mechanisms.** Peak, M.J.; Peak, J.G.; Carnes, B.A. (Argonne National Lab., IL, USA). *Photochemistry and Photobiology;* **45**: No. 3, 381-387(Mar 1987).

An action spectrum for the immediate induction in DNA of single-strand breaks (SSBs, frank breaks plus alkali-labile sites) in human P3 teratoma cells in culture by monochromatic 254-, 270-, 290-, 313-, 334-, 365-, and 405-nm radiation is described. Irradiation of the cells in a D_2O environment (compared with the normal H_2O environment) did not alter the rate of induction of SSBs by 290-nm radiation, whereas the D_2O environment enhanced the induction of SSBs by 365- and 405-nm irradiation. Analysis of the relative efficiencies for the induction of SSBs revealed a spectrum that coincided closely with nucleic acid absorption below 313 nm. At long wavelengths, the plot of relative efficiency vs. wavelength contained a minor shoulder in the same wavelength region as that observed in a previously obtained action spectrum for stationary phase Bacillus subtilis cells. Far-UV radiation induced few breaks relative to pyrimidine dimers, whereas in the near-UV region of radiation, SSBs account for a significant proportion of the lesions relative to dimers, with a maximum number of SSBs per lethal event occurring at 365-nm radiation.

12689 **Some implications of dose accuracy for radiation response.** Schimmerling, W. (Univ. of California, Lawrence Berkeley Lab., Berkeley, CA 94720). pp 84 of Thirty-fifth annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1987). (CONF-870221—).

From 35. annual meeting of the Radiation Research Society; Atlanta, GA, USA (22 Feb 1987).

The dose delivered to patients undergoing radiotherapy is known with finite accuracy and precision. If the uncertainties associated with absolute dose and reproducibility are too large, the results of a clinical trial may be vitiated. Some of the required limits on accuracy and precision are investigated from the point of view of their possible effect on radiation responses, such as the tumor cure probability resulting from a clinical trial. An upper limit of 5% on the overall dose uncertainty is seen to be adequate in most cases, if patients statistics are not a limiting factor.

12690 **A brachytherapy model using /sup 125/I in a transplantable murine tumor.** Jonos, E.L.; Lyons, B.E.; Douple, E.B.; Filimonov, A. (Radiobiology Labs., Dartmouth-Hitchcock Medical Center, Hanover, NH 03756). pp 83 of Thirty-fifth annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1987). (CONF-870221—).

From 35. annual meeting of the Radiation Research Society; Atlanta, GA, USA (22 Feb 1987).

The effects of low dose rate irradiation (brachy-therapy) were investigated in vivo using a murine mammary adenocarcinoma (MTG-B). Transplanted tumors growing in the flanks of C3H mice were irradiated at diameters of 9.5-11 mm (0.45-0.70). A total of 8 experiments were performed over a 3 month interval. In each experiment two groups (radiation and sham controls) were analyzed, each containing 8-15 mice (N=137). A linear relationship was observed between the total dose and the mean growth delay (MGD). These results are compared to the MGD caused by 20 Gy of acute dose (517 cGy/min) x-rays in a single dose or 5 daily fractions of 4 Gy/fraction. These results suggest that this model is an appropriate system for brachy-therapy studies and is well suited for investigating interactions between low dose rate irradiation and hyperthermia and/or chemotherapy.

12691 **Effect of 2-[(aminopropyl)amino] ethanethiol (WR 1065) on radiation-induced DNA damage and repair and cell progression in V79 cells.** Grdina, D.J.; Nagy, B. (Argonne National Lab., IL, USA; Chicago Univ., IL, USA; Central Inst. for Tumors and Allied Diseases, Zagreb, YU). *British Journal of Cancer;* **54**: No. 6, 933-941(Dec 1986).

The radioprotector 2-[(aminopropyl)amino] ethanethiol (WR 1065) was investigated with respect to its ability to affect radiation-induced DNA damage and repair in V79 cells. At a concentration of 4mM, WR 1065 protected against the formation of single strand breaks (SSB), when present during irradiation. The protector appeared, however, to inhibit the subsequent postirradiation repair or rejoining of SSB. While repair was complete within 24h, the protector reduced the rate of repair by a factor of 3. This inhibitory effect on the rate of repair did not correlate with either measured differences in cell survival or mutagenesis. WR 1065 present in the growth medium inhibited the progression of cells through S-phase, and cell-doubling time following a 3h exposure to the protector was increased from 11 to 18h. These data are consistent with the property of thiols to inhibit DNA polymerase activity. It was concluded that, while the presence of WR 1065 during irradiation reduced SSB-DNA damage, its effect on the subsequent rejoining of these breaks could not be correlated with its observed effect on protecting against radiation-induced mutagenesis.

12692 **Uptake and clearance of plutonium-238 from liver cells transplanted into fat pads of F344 rats.** Brooks, A.L.; Guilmette, R.A.; Hahn, F.F.; Jirtle, R.L. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM, USA. Inhalation Toxicology Research Inst.; Duke Univ., Durham, NC, USA). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* **50**: No. 4, 631-639(Oct 1986).

Animals injected with liver cells and control animals received a single intraperitoneal injection of 37 kBq (1 μCi) ^{238}Pu citrate and were serially sacrificed. It was observed that the cells of the intact liver took up about twice as much ^{238}Pu as liver cells transplanted into the fat pads of the same animal. The retention half-life was 8.3 days for the total activity in the liver, 20 days using tracks/cell measurements in the liver and 16 days for the tracks/cell measurements in the liver cells translocated to fat pads. When the data on tracks/cell were standardized relative to the amount of Pu present at 5 days after injection, there was no significant difference between the retention of Pu in liver cells from intact animals and liver cells transplanted into the fat pads. About 20% of the 5-day Pu liver burden in both liver cells and liver cells transplanted into fat pads was retained at 70 days. The smaller retention and clearance for liver cells in different environments indicate that uptake and clearance of Pu from the body is dependent, to a major extent, upon hepatocyte function.

12693 **VUV absorption and its relation to the effects of ionizing corpuscular radiation.** Inokuti, M. (Argonne National Lab., IL, USA). *Photochemistry and Photobiology;* **44**: No. 3, 279-285(Sep 1986). (CONF-8510268—). Contract W-31-109-ENG-38.

From United States-Japan joint seminar on ultraviolet photobiology and spectroscopy; Upton, NY, USA (2 Oct 1985).

Elements of the physics of photoabsorption as well as of energy transfer from fast charged particles are discussed. Among the key notions there are oscillator-strength spectra, quantum yields, and action spectra. Throughout the discuss-ion, emphasis is put on the important role of soft X-rays and VUV light as obtained from a synchrotron radiation source in the understanding of actions of ionizing radiations in general.

12694 **Quantitation of DNA damage in non-radioactive DNA.** Sutherland, B.M.; Sutherland, J.C.; Ciarrocchi, G.; Ciomei, M. (Brookhaven National Lab., Upton, NY, USA; Istituto di Genetica, Biochimica, ed Evoluzionistica, Pavia, IT). *Photochemistry and Photobiology;* **44**: No. 3, 391-396(Sep 1986). (CONF-8510268—).

From United States-Japan joint seminar on ultraviolet photobiology and spectroscopy; Upton, NY, USA (2 Oct 1985).

Three principal methods have been developed for measuring femtomoles of damage in nanogram quantities of non-radioactive DNA. Lesions which can be quantified include single and double strand breaks, alkali labile sites including apurinic and apyrimidinic sites, and pyrimidine dimers. The first in vitro method measures the conversion of supercoiled DNA to relaxed or linear molecules, and can detect up to four lesions per molecule. The second in vitro method (supercoil depletion) assesses the fraction of intact linear molecules of homogeneous length, and allows detection of 8 lesions/molecule. The third method, measurement of molecular length distributions of DNAs of heterogeneous length, reveals the extent of DNA damage and repair in vivo or in vitro.

12696 **Observations on the photosensitized breakage of DNA by 2-thiouracil and 334-nm ultraviolet radiation.** Peak, J.G.; Peak, M.J.; Foote, C.S. (Argonne National Lab., IL, USA; California Univ., Los Angeles, USA. Dept. of Chemistry). *Photochemistry and Photobiology;* **44**: No. 2, 111-116(Aug 1986).

Breaks induced in purified DNA by 334-nm ultraviolet (UV) radiation are enhanced 30 times when 2-thiouracil (s^2Ura) is present during aerobic irradiation. This enhancement by s^2Ura is maximally effective at a concentration of about 1 mM. Anoxic irradiation reduces the s^2Ura-enhanced breakage by 90%, indicating a Type II photosensitization. Benzoate, glycerol, diazabicyclo[2.2.2.]octane (DABCO) and histidine all inhibit formation of s^2Ura photosensitized breaks, unlike diethylenetriaminepenta-acetic acid (DETAPAC) and catalase, which do not. The relationships between the concentration of DABCO, benzoate and histidine and their protection against induction of single strand breaks (SSBs) were similar, with little inhibition below 10 mM and maximal inhibition near 0.1 M for all compounds. Irradiation of the DNA-s^2Ura mixture dissolved in D_2O instead of H_2O enhanced the rate of induction of SSBs in DNA by 334-nm light almost five times. Addition of superoxide dismutase (40, 80 and 200 μg/ml) decreased the rate of induction of breaks in DNA by 334-nm radiation plus s^2Ura (in H_2O) by about 40%. Boiled superoxide dismutase had no effect.

12696 **Real hazards of nuclear fallout.** Knox, J.B.; Shapiro, C.S. (Lawrence Livermore National Lab., CA, USA; San Francisco State Univ., CA, US. Dept. of Physics). *Nature (London);* **321**: No. 6065, 21-22(1 May 1986). Contract W-7405-ENG-48.

The paper discusses an article by Carl Sagan entitled "On minimizing the consequences of nuclear war" [Nature 317 485 Oct 1985], in the light of the authors' own work on global fallout. Consequences of local fallout, human impact of local fallout, and global fallout calculations using computer models, are all described. (U.K.).

12697 **Plant uptake of neptunium-237 and technetium-99 under field conditions.** Garten, C.T. Jr.; Tucker, C.S.; Scott, T.G. (Oak Ridge National Lab., TN, USA). *Journal of Environmental Radioactivity (London);* **4**: No. 2, 91-99(1986). Contract AC05-84OR21400.

Plant uptake of ^{99}Tc freshly added to soils was compared with uptake of ^{99}Tc 'aged' in soil for more than a decade. A combination of alkaline soil and freshly added ^{99}Tc resulted in elevated uptake into radish foliage (plant/soil concentration ratios ranged from 37 to 46). Neptunium-237 was freshly added to all soils. Neptunium uptake via plant roots into foliage was strongly affected by soil pH. Neptunium uptake was greatest from acidic soils. The observed plant/soil concentration ratios for ^{237}Np under field conditions were approximately 10^{-2} from acidic soils and were comparable to field concentration ratios for ^{239}Pu, that is 10^{-3}, from a basic soil.

12698 **High concentrations of ^{226}Ra and ^{241}Am at human bone surfaces: implications for the ICRP 30 bone dosimetry model.** Schlenker, R.A.; Oltman, B.G. (Argonne National Lab., IL, USA). *Radiation Protection Dosimetry;* **16**: No. 3, 195-203(1986).

High concentrations of ^{226}Ra and ^{241}Am relative to those in bone volume have been found at locations bordering human bone surfaces, 25 to 52 years after first exposure. The zones of high concentration extend from the bone surface to depths between 2 and 4.3 μm for ^{226}Ra and to a depth of 0.6 μm for ^{241}Am, as determined by a quantitative analysis of alpha particle spectra, based on a model of radionuclide distribution within bone. The ratio of concentration in the surface zone to the concentration deeper within bone lies in the range 2.5 to 6 for ^{226}Ra and equals 16 for ^{241}Am. These results suggest that the spatial distribution assumptions of the ICRP 30 model for bone dosimetry are incorrect, but that high concentrations of ^{241}Am at bone surfaces persist for decades, in agreement with the model.

12699 **Radionuclide complexation in xylem exudates of plants.** Cataldo, D.A.; McFadden, K.M.; Garland, T.R.; Wildung, R.E. (Pacific Northwest Lab., P.O. Box 999, Richland, WA 99352). pp 398-408 of Speciation of fission and activation products in the environment. Bulman, R.A.; Cooper, J.R. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-850473—). Contract AC06-76RL01830.

From Seminar on the speciation of fission and activation products in the environment; Oxford, UK (16 Apr 1985).

The plant xylem is the primary avenue for transport of nutrient and pollutant elements from the roots to aerial portions of the plant. It is proposed that the transport of reactive or hydrolyzable ions is facilitated by the formation of stable/soluble complexes with organic metabolites. The xylem exudates of soybean (Glycine max cv. Williams) were characterized as to their inorganic and organic components, complexation patterns for radionuclides, both in vivo and in vitro, and for class fractions of exudates using thin-layer electrophoresis. The radionuclides Pu-238 and Fe-59 were found primarily as organic acid complexes, while Ni-63 and Cd-109 were associated primarily with components of the amino acid fraction. Technetium-99 was found to be uncomplexed and transported as the pertechnetate ion. It was not possible to duplicate fully complexes formed in vivo by back reaction with whole exudates or class fractions, indicating the possible importance of plant induction processes, reaction kinetics and/or the formation of mixed ligand complexes.

12700 **Influence of chemical form, feeding regimen, and animal species on the gastrointestinal absorption of plutonium.** Bhattacharyya, M.H.; Larsen, R.P.; Cohen, N.; Ralston, L.G.; Oldham, R.D.; Moretti, E.S.; Ayres, L. (Argonne National Lab., Argonne, IL). pp 200-207 of Speciation of fission and activation products in the environment. Bulman, R.A.; Cooper, J.R. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-850473—).

From Seminar on the speciation of fission and activation products in the environment; Oxford, UK (16 Apr 1985).

The author evaluated the effect of chemical form and feeding regimen on the gastrointestinal (GI) absorption of plutonium in adult mice at plutonium concentrations relevant to the establishment of drinking water standards. Mean fractional GI absorption values in fasted adult mice were: Pu(VI) bicarbonate, 15 x 10/sup -4/; Pu(IV) bicarbonate, 20 x 10/sup -4/; Pu(IV) nitrate (pH2), 17 x 10/sup -4/; Pu(IV) citrate, 24 x 10/sup -4/; and Pu(IV) polymer, 3 x 10/sup -4/. Values in fed adult mice were: Pu(IV) bicarbonate, 1.4 x 10/sup -4/; Pu(IV) polymer, 0.3 x 10/sup -4/. Pu(VI) is the oxidation state in chlorinated drinking waters and Pu(IV) is the oxidation state in many untreated natural waters. To assess the validity of extrapolating data from mice to humans, the author also determined the GI absorption of Pu(VI) bicarbonate in adult baboons with a dual-isotope method that does not require animal sacrifice. Fractional GI absorption values obtained by this method were 23 +- 10 x 10/sup -4/ for fasted baboons (n=5) and 1.4 +- 0.9 x 10/sup -4/ for fed baboons (n=3). We have so far validated this method in one baboon and are currently completing validation in two additional animals. At low plutonium concentrations, plutonium oxidation state [Pu(VI) vs. Pu(IV)] and administration medium (bicarbonate vs. nitrate vs. citrate) had little effect on the GI absorption of plutonium in mice. Formation of Pu(IV) polymers and animal feeding decreased the GI absorption of plutonium 5- to 10-fold. The GI absorption of Pu(IV) bicarbonate in both fed and fasted adult baboons appeared to be the same as in fed and fasted adult mice, respectively.

12701 **Chemical modification of cellular response to Californium-252.** Goud, S.N.; Schroy, C.B.; Magura, C.; Feola, J.M.; Maruyama, Y. (Dept. of Radiation Medicine, Univ. of Kentucky Medical Center, Lexington, KY 40536). pp 101 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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The effects of caffeine and dimethyl-sulfoxide (DMSO) on the cytotoxic effects of Cf-252 were studied using human T-1E cells. Cf-252 emits neutrons with a mean energy of 2.3 MeV. Two

thirds of the absorbed dose is from neutrons, the remainder from gamma rays. The neutrons have a RBE value of 2 to 10. Exponentially growing cells were exposed for up to 2h in suspension to radiation emitted by encapsulated Cf-252 sources. Total Cf-252 was 350 mcg. At the end of each exposure, appropriate aliquots of cell suspension were removed, counted, and plated. DMSO (2M) was present during irradiation and caffeine (2mM) was added immediately after irradiation and was present for 48h. Cell survival curves show potentiation of cell killing by caffeine and radioprotection by DMSO. The DMSO results indicate the probability of scavengable free radical killing by Cf-252. The caffeine data indicate that potentially lethal damage exists in the cells after exposure to this high LET radiation source.

12702 **Experimental aspects of chemical damage to DNA produced by radiation.** Trumbore, C.N. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 130 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC03-76SF00098.

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Air saturated aqueous solutions of double stranded SV40 DNA were chosen for initial study of radiation damage to DNA. In such solutions the analysis for single and double strand breaks can be performed by a relatively simple technique involving electrophoresis. Early work has focused on the indirect effects involving water radicals (presumably OH) from particles of various LET's available from LBL accelerators. Experimental results of strand breaks for various qualities of radiation are presented. Implications for the radical mechanisms are discussed based on these results.

12703 **Possible mechanisms for damage of DNA by OH radicals.** Chatterjee, A. (Lawrence Berkeley Lab., MS 29-100, Univ. of California, Berkeley, CA 94720). pp 130 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC03-76SF00098.

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It has been widely assumed that effects of radiation on DNA in solution are initiated by reaction with OH radicals. The mechanisms involved in the radiolysis of aqueous solutions are well known and so the authors have made an elementary examination of the possible roles of OH radicals in solutions of DNA. Starting from the concept of spur and adopting a procedure based on Monte Carlo technique, results are presented to show how various radical products decay in pure water for low-LET irradiation. Following the same technique results are also presented for the extent of single strand breaks and double strand breaks in SV40 DNA caused by -OH radicals. The present theoretical status of high-LET track effects for evaluating DNA damage in aqueous solution is discussed also.

12704 **Physical and chemical reactions following irradiation of aqueous systems.** Wright, H.A. (Health and Safety Research Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 129 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC05-84OR21400.

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Calculations have been made to link radiation physics and radiation chemistry of aqueous systems. A Monte Carlo computer code has been developed to calculate the details of all of the interactions that follow the passage of a charged particle through liquid water from the physical stage (—10/sup -15/ s) through the diffusion and chemical reaction stage (—10/sup -6/ s). Calculations have also been made of direct physical and indirect chemical reactions with DNA in a water solution.

12705 **A deep sieve model for heavy ion radiobiology.** Almasi, J.J.; Tobias, C.A.; Kraft, G.; Blakely, E.A. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 121 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC03-76SF00098.

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Recent experiments on heavy ions from He to U in the energy range between 0.5-960 MeV/μ resulted in anomalous cross section for inactivation of Chinese hamster cells in vitro. The cross sections increased with LET approximately to the projected area of the cell nucleus; at very high LETs, near the stopping point of the particles, the cross sections decreased again with decreasing particle residual range, and separated for very heavy ions. A possible explanation of such behavior may be related to the fact that the radial dimensions of particle tracks, limited by the maximum range of the delta rays, also decline with diminishing residual range. The authors calculated some track radii for various track energy densities. They also assume that nuclear DNA does not fill the entire nucleus uniformly, but that there are some empty spaces between chromatin threads. Multiple layers of chromatin in the cell nucleus might appear to an observer traveling with the particles as multilayered sieves. In a calculation similar to that performed for much smaller targets and for yeast cells, the authors find that they can approximate the experimental results.

12706 **Radiation dose as experienced by the cell nucleus.** Marshall, I.R.; Grahn, D. (Argonne National Lab., Argonne, IL 60439). pp 119 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract W-31-109-ENG-38.

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Dose to the nucleus is the most important factor in cell death, the induction of mutation, or transformation. Analysis of dose response functions based upon nuclear dose alone leads to several considerations. (1) Some differences in radiation sensitivity of cells within the same line and cell stage might be due to differences in nuclear size. (2) Increased radiation dose, if given instantaneously, not only increases the numerical value but also changes the radiation quality for the nucleus. For each dose, energy deposition spectra can be calculated from measured single event microdosimetric spectra. (3) Depending on energy deposition in the nucleus, there will be certain probabilities that the damage produced will result in cell killing, mutation, or transformation. Data on postspermatogonial dominant lethal mutations, scored as postimplant fetal death, induced in mice by neutrons from the Argonne JANUS reactor, are being used to test the concepts. Early results indicate the importance of both nuclear volume and the specific germ-cell stage.

12707 **Induction of gene expression in mammalian cells by heavy ions.** Mei, M.T.; Craise, L.M.; Yang, T.C. (Biology and Medicine Div., Univ. of California, Lawrence Berkeley Lab., Berkeley, CA 94720). pp 101 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC03-76SF00098.

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Using an established mammalian cell line, Chinese Hamster Ovary cells (CHO-K1), the authors have observed the mutagenic effects of various heavy ions. Cell line CHO-K1 requires proline for normal growth in medium with low serum concentration. X-rays and three types of heavy particles (600 MeV/μ iron, 670 MeV/μ neon, and 300 MeV/μ silicon ions) were used to induce gene expression mutation with reversed cells to proline independence. The mutation frequency per viable cell appears to be dose dependent for these four types of radiation, and the dose-response curves are curvilinear. The authors results also indicate that the effectiveness of high-ET particles, for example Fe/sup 56/, in inducing proline prototrophs is much stronger than that of low-LET radiation, for example X rays and ne/sup 20/. By using mutation frequency induced

by X-ray dose 640 rad, which produced 10% survival as the reference point, they calculated the RBE value for mutation.

12708 **Interdependence of glucose and oxygen supply for regulation of oxygenation in multicell spheroids.** Muller-Klieser, W.; Freyer, J.; Sutherland, R. (Univ. Mainz). pp 134 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

O/sub 2/ tensions (P/sub O2/) in EMT6/Ro spheroids were studied using microelectrodes. Spheroids is stirred media equilibrated with air on 5% O/sub 2/ containing 4 different glucose concentrations exhibited markedly different P/sub O2/ profiles. O/sub 2/ and glucose supply conditions during spheroid growth influenced the number of viable and respiring cells as well as the respiration rate of the cells in the spheroids as revealed by histological investigations, measurements of consumption, and theoretical considerations. In general, lowering of the glucose concentration was associated with a decrease in viable rim thickness and an increase in cellular respiration rate. O/sub 2/ and glucose consumption in spheroids decreased with increasing spheroid size under most of the growth conditions investigated.

12709 **Radiation sensitivity and G2 arrest in x-ray sensitive chinese hamster ovary (CHO) cells.** Chen, J.; Tokita, N.; Jeggo, P.A. (Life Sciences Div., Los Alamos National Lab., Los Alamos, NM 87545). pp 118 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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It has been demonstrated that radiation induced double strand breaks (dsb) or non-rejoining DNA breaks arrest cells almost exclusively in the G2 phase of the cell cycle. Recently, it has also been suggested that G2 is a period of DNA repair, since a reduction in G2 delay results in decreased cell survival. To study correlations between cell survival, repair of dsb and G2 block, the magnitude of radiation-induced G2 block was measured for two CHO-K1 lines differing in radiosensitivity (—5-fold at the 10% survival level). The author's results indicate that the mutant cells are defective in dsb repair. At a given dose of x-rays, the mutant cells are twice as sensitive for radiation-induced G2 block than the wild-type CHO-K1 cells and the duration of G2 block is considerably longer after x-irradiation.

12710 **Differences in the repair of oxygen-independent and -dependent radiation damage.** Braby, L.A.; Nelson, J.M.; Metting, N.F. (Pacific Northwest Lab., Richland, WA 99352). pp 119 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC06-76RL01830.

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Several lines of evidence suggest that different chemical products are responsible for the damage produced in cells irradiated in the presence and absence of oxygen. It is also becoming evident that two or more repair processes contribute to the recovery of cells exposed to fractionated irradiation or allowed extended time for post irradiation repair. New experiments on repair in plateau phase CHO cells exposed to 1.5 MeV electrons indicates that the damage which is produced only in the presence of oxygen is sublethal in nature. This damage must interact with additional damage, usually produced by a second charged particle interaction, in order to become potentially lethal. On the other hand, all of the damage produced during anoxic irradiation seems to be potentially lethal since it is repaired most efficiently in a delayed plating experiment. This strongly suggests that the oxygen-dependent and -independent damage are not only chemically different, but also differ in their effect on the information encoded in the DNA and in their repair requirements. There may also be effects of oxygen on the performance of repair mechanisms which remain to be fully explored. These effects may provide additional information on the characteristics of the damage.

12711 **Weibull-type risk estimators for early mortality and morbidity effects of exposure of humans to ionizing radiation.** Scott, B.R.; Hahn, F.F.; Cuddihy, R.G.; Boecker, B.B. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM 87185). pp 106 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC04-76EV01013.

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In the Reactor Safety Study (WASH 1400, NUREG-75/014, 1975), which provided quantitative estimates of the health impacts of a light-water nuclear power plant accident, several types of risk estimators (mathematical functions used to generate risk estimates) were used: (1) the bimodal-Gaussian type; (2) the unimodal-Gaussian type; (3) the linear-threshold type; (4) the power-function type, and (5) complex (not stated mathematically) types. In the authors analysis, these different types or risk estimators have been replaced by a unimodal-Weibull type. This provides for a systematic representation of both morbidity and mortality risks. In addition, risk estimators have been developed for risks not modeled in the Reactor Safety Study. These include hypothyroidism, mental retardation after in utero exposure, skin erythema, transepithelial injury, and cataracts. Tolerance-dose distributions associated with the risk estimators are presented and their implications discussed.

12712 **Comparison of recovery in the rat lens epithelium after x-ray, fission neutron, or /sup 56/Fe particle irradiation.** Riley, E.F.; Lindgren, A.L.; Ainsworth, E.J. (Radiation Research Lab., Dept. of Radiology, Univ. of Iowa, Iowa City, IA 52242). pp 102 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

The authors are comparing the radiobiological effectiveness of 10 Gy (1000 rads) of 250 kVp X-rays, 2 Gy (200 rads) of fission neutrons, and 1.5 Gy (150 rds) of 600 MeV /sup 56/Fe particles (LET about 180-200 keV/μm). They are evaluating the persistence of latent radiation damage and the very slow recovery (> 1 month) in cells of the central zone of the rat lens epithelium. The central zone is essentially a G/sub o/ population of cells (1 mitotic figure per 2000 cells). These cells normally respond to the mitogenic stimulus of wounding with a "burst" of DNA synthesis at 14 hours and a "burst" of mitosis at 24 hours after wounding. Irradiation before wounding causes a delay and suppression of the response. With increasing time between irradiation and wounding, the authors note less delay and less suppression of the response. They also note fewer abnormal mitotic figures. For example, at 28 days the X-irradiated, neutron irradiated, and iron irradiated cells developed respectively, 39%, 36%, and 21% fewer abnormal mitotic figures than at 7 days post-irradiation. Slower recovery after /sup 56/Fe particle irradiation is indicated. They are now comparing the amounts of delay and suppression of the responses after exposure to the different radiations.

12713 **The homeotic skeletal shift test as an indication of teratogenic risk of x-ray or MRI exposure.** Fong, P.L.; Heinrichs, W.L.; Flannery, M.; Spindle, A.; Crooks, L.E.; Pedersen, R.A. (Lab. of Radiobiology and Environmental Health, Dept. of Radiology, Univ. of California, San Francisco, CA 94143). pp 127 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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The authors examined the teratogenic risk of midgestation exposure to X-rays or Magnetic Resonance Imaging (MRI) in BALB/c in mice using the homeotic shift test of skeletal features. This test measures teratogenic injury to cartilaginous and osseous tissues as shifts in the number of costosternal junctions, sternebrae, thoracic ribs, and axial vertebrate. The X-ray exposures were performed to evaluate the sensitivity of this test. Pregnant mice were exposed to 0, 25, 50, or 100 rads X-rays on gestational day 9 1/4. At term, fetuses were processed and scored for skeletal shifts. Ad-

ditional ribs, costosternal junctions, thoracic vertebrae and presacral vertebrae resulted from exposure to 50 or 100 rads X-rays. Fetuses exposed to MRI (0.35 Tesla, pulsed gradients 2.3 x 10/sup -4/ T/cm for 2.5-10m sec; 15 MHz RF at 61 mW for 15H) demonstrated no significant skeletalshifts. This approach should be valuable for evaluating the safety of MRI and of fetal exposures to other radiation sources.

12714 **Potentially lethal damage (PLD) of spleen hemopoietic CFU-S detected by pulsating magnetic fields (PMF).** Maruyama, Y.; Magura, C.; Feola, J.M.; Goud, S.N. (Radiation Medicine, Univ. of Kentucky Med. Ctr., Lexington, KY 40536). pp 105 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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The authors examined a normal tissue stem cell, i.e. spleen CFU-S, for PLD capability using endogenous CFU-S. C57BL mice were total body irradiated with single dose between 500-700 rad of acute Co-60 radiation. They exposed the mice to varying durations/ schedules of PMF. 600 cGy irradiated mice were exposed to PMF for periods of 24 hrs. beginning at 9 mins., varied to 3 hrs. Surviving CFU-S were 14.2+-3.4(SEM) and spleen weight was 52.3+-9.0 mg. This decreased to 3.8+-0.6 and 28+-2.4 mg. when PMF was started at 3 hrs. It was variably decreased at intermediate times. PMF duration was varied from 4-48 hrs. and maximal inhibition of PLD repair occurred at 8-24 hrs. but gone at 48 hrs. Radiation dose-response curves showed effects consistent with PLD. PLD can be shown by spleen weight or CFU-S count and can be promoted or inhibited by PMF. The findings extend observations from tumors and cultured cells to a normal tissue stem cell in situ. Studies of low dose rate Cs-137 and Cf-252 neutron irradiation are underway and will be reported.

12715 **Temperature sensitivity of a recovery process in L5178Y mouse lymphoma strain LY-R.** Evans, H.H.; Mencl, J.; Horng, M.F. (Case Western Reserve Univ., Cleveland, OH 44106). pp 136 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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The authors previously reported that the survival of two closely related L5178Y strains, LY-R and LY-S, is dose-rate dependent when the cells are subjected to low dose-rate irradiation while in exponential growth. Strain LY-S is more sensitive to the lethal effects of radiation, and its survival is less dose-rate dependent than strain LY-R when dose rates of 53 and 0.02 Gy/hr are compared. When the cultures were subjected to low dose-rate radiation at 25°C (a temperature at which cell division is inhibited), the survival of strain LY-R was markedly decreased in comparison to radiation at 37°. The survival of strain LY-S was similar whether the cells were incubated at 25° or 37° during the low dose-rate radiation. The repair of potentially lethal damage during incubation at 25° following high dose-rate irradiation occurred in strain LY-S but not strain LY-R. The survival of strain LY-S during the post-irradiation recovery was inhibited by addition of 3-aminobenzamide to the medium at a concentration of 2mM. The results indicate that a repair of recovery process occurs in strain LY-R at 37° but not at 25°.

12716 **Experimental induction of skin cancer with x-rays.** Fry, R.J.M.; Ogle, S.; Triplett, L. (Biology Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 103 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC05-84OR21400.

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The human skin is exposed to many agents especially ultraviolet radiation. This mixture of exposures makes it difficult to estimate the risk of cancer induction due to exposures of any single agent such as X-rays. As part of a study concerned with the interaction of agents and skin cancer the authors investigated the promotion of X-ray initiated cells by 12-0-tetradecanoyl phorbol-13-acetate (TPA). Female SKH:hairless-1 mice were exposed to 0, 2, 4, 8, and 16 fractions of 250R X-rays and were subsequently treated with 5 μg TPA 2 times per week. Another group of mice were exposed to 0, 4, 8 and 16 fractions of X-rays with no subsequent treatment. The incidence of squamous cell carcinomas, and other tumors, in both groups has been determined at 80 weeks. Treatment with TPA, X-rays, and X-rays followed by TPA resulted in incidences of 0.0%, 2.0% +- 2.0 and 80.0% +- 7.0 of carcinomas respectively.

12717 **The rate of progression of radiation transformed cells is enhanced after low dose rate neutron.** Ullrich, R.L. (Biology Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 104 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Female BALB/c mice were irradiated with fission-spectrum neutrons at dose rates of 2 rad/min or 1 rad/day. 24 hours or 16 weeks after irradiation, mammary cells were obtained by enzymatic dissociation. Mammary outgrowths were derived by injection of 10/sup 4/ cells into gland-free fat pads of 3-week-old female BALB/c mice. The frequency and persistence of ductal dysplasias in outgrowths were assessed at 10 and 16 weeks. Frequencies of ductal dysplasias in 10 week outgrowths from cells irradiated at high or low dose rates were similar. Persistence of dysplasias differed markedly. Few of the dysplasias in outgrowths derived from cells irradiated at the high dose rate persisted, while a large fraction of the dysplasias in outgrowths derived from cells irradiated at the low dose rate persisted. These data suggest that low dose rate neutron exposures enhance the probability of progression of carcinogen altered cells rather than increase the numbers of initiated cells.

12718 **Protective effect of WR2721 against the induction of altered hepatocyte foci in rats treated once with gamma irradiation within one day after birth.** Grdina, D.; Peraino, C.; Angerman, J.; Staffeldt, E. (Argonne National Lab., Argonne, IL 60439). pp 104 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract W-31-109-ENG-38.

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

The authors investigated the protective effects of WR2721 on the induction by radiation of altered hepatocyte foci in 150-day-old Sprague Dawley rats. One hundred micrograms of WR2721 per gram of body weight were administered to selected groups of neonatal animals 30 min prior to the administration of single doses of γ irradiation (150 or 300 rad). Focus pheotypes, gamma-glutamyltranspeptidase (GGT) and/or the iron exclusion histochemical markers, were quantitated through the use of serial frozen sectioning techniques and computer-assisted image analysis. Radiation was effective in inducing foci formation. Induction was much more effective in female as compared to male rats. WR2721 reduced the frequencies of radiation-induced foci at both radiation doses, with the greatest effect apparent in female rats. The protective effect of WR2721 in this system suggests that this compound and related aminothiols may be useful probes for examining mechanisms of mutagenesis and carcinogenesis induced by radiation or chemicals.

12719 **Oocyte loss in macaques from chronic tritiated water exposure before birth.** Dobson, R.L.; Kwan, T.C.; Hendrickx, A.G. (Lawrence Livermore National Lab. and California Primate Research Center, Univ. of California, Livermore, CA 94550). pp 126 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract W-7405-ENG-48.

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Because massive oocyte loss had been found in squirrel monkeys following low-level /sup 3/HOH exposure prenatally, two species of macaque, rhesus and bonnet monkeys (Macaca mulatta and M. radiata), were studied to test whether intense germ-cell radiosensitivity exists also in other primates before birth (hence perhaps in man). Adult females received 5 μCi/ml of /sup 3/HOH in

drinking water from the time pregnancy was hormonally confirmed until shortly after parturition, giving measured body-water levels of 4 μCi/ml, delivering 0.9 rad/day. From the female offspring, ovaries were removed soon after birth and at 6 months; oocytes were enumerated in serial sections. In the newborns, germ-cell deficiencies (comparisons with controls) were about 20%, much less than seen in squirrel monkeys. By 6 months, however, losses were striking: 60% in rhesus and 95% in bonnet monkeys. Such losses, from less than 1 rad/day and seen varyingly in all three primate species examined, warn of possible high prenatal germ-cell vulnerability in the human female.

12720 **Derivation of the "dose rate factor" from a low dose formulation of the lethal-potentially lethal (LPL) model.** Curtis, S.B. (Lawrence Berkeley Lab., Berkeley, CA 94720). pp 120 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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The "dose rate factor" G(T/tau) = 2/(T/tau)/sup 2/ [T/tau -1 + exp (-T/tau)] (1) with T = irradiation time = D/D, tau = mean repair time, arises in the Dual Radiation Action, Accumulation, and Molecular theories. It represents the factor by which the quadratic term in the absorbed dose must be multiplied to accommodate the case when lesions are being formed and repaired during irradiation. The Lethal, Potentially Lethal (LPL) Model assumes that two types of lesions (irrepairable, eta/sub L/, and repairable, eta/sub PL/) are formed by the radiation, with the repairable lesions able to interact to produce a lethal lesion. The differential equations are: deta/sub PL/dt = eta/sub PL/ D - ϵ/sub PL/eta/sub PL/ -ϵ/sub 2PL/eta/sub PL/-ϵ/sub 2PL/eta/sub PL//sup 2/ (2); deta/sub L//dt = eta/sub L/D + ϵ/sub 2PL/eta/sub PL//sup 2/ (3) If the last term in equation (2) can be neglected, the solution of the resulting equations yields the above "dose rate factor," if the available repair time is long compared with the mean repair time. Thus, the authors conclude that the generalized LPL formation, which applies at high as well as at low doses, embodies the linear-quadratic formulation as a special case restricted in its validity to low doses and long repair times.

12721 **Target size in radiobiology.** Katz, R.; Dunn, D.E.; Sinclair, G.L. (Univ. of Nebraska, Lincoln, NE 68588-0111). pp 120 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

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In the region of thindown, target size plays a larger role in the calculation of action cross-sections than elsewhere in the track-width regime. If the target is small compared to the "delta-ray track width" this width may determine the cross-section, while if the target is large the target size may determine the cross-section. As a consistency test of track theory the authors examine the implications of target size estimates drawn from survival data in the grain-count regime for action cross-sections in the thindown region. From cellular radiosensitivity parameters obtained earlier (for similar but different cells) the authors extract the theoretical target size. They then calculate the ion-kill cross-sections for these cells and the HZE ions used in GSI-Darmstadt experiments, and join these results to our earlier findings. The cross-section calculations are limited by lack of knowledge of the radial distribution of dose for these particles, but simply extrapolating formulas developed earlier (somewhat beyond their limit of validity), their cross-section calculations yield qualitative agreement with much of the experimental data. Target size implications from track theory seem to have physical reality.

12722 **Increased radiation-induced division delay in 9L spheroid as compared to monolayer cultures.** Sweigert, S.E.; Alpen, E.L. (Dept. of Biophysics, Univ. of California-Berkeley, Berkeley, CA 94720). pp 116 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Radiation-induced division delay was compared in 9L glio-sarcoma cells growing as spheroids or as exponential monolayers, using the technique of percent labeled mitoses (PLM). The time required to reach the half-height of the first peak of labeled mitoses following 800 rads of X-ray was 8 hr for spheroid cells, as compared to 4.9 hr for monolayer cells (G/sub 2/ + 1/2M of control cells = 2.25 hr for both). For doses ranging from 100 to 800 rad the efficency of delay induction was approximately twice as great in spheroids as in monolayers. Cells in small spheroids (150 μm diameter) were delayed to the same extent as cells in large spheroids (800 μm diameter). The increased delay of 9L cells grown as spheroids may be another manifestation of the 'contact effect,' previously observed as enhanced radiation survival of 9L spheroid cells. In that context, these results are consistent with the hypothesis that radiation-induced G/sub 2/ delay is a period in which cells repair damage before proceeding to mitosis.

12723 **Evidence for the production of both sublethal and potentially lethal damage in plateau phase CHO cells.** Nelson, J.M.; Metting, N.F.; Braby, L.A. (Pacific Northwest Lab., Richland, WA 99352). pp 118 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC06-76RL01830.

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Models of the effects of ionizing radiation on cells generally assume that the initial damage is either entirely potentially lethal or both potentially lethal and sublethal in nature. These models, based on very different assumptions can often be made to predict the same response as a function of dose fractionation by assuming different mechanisms. Since the predicted results of most experiments cannot discriminate between these models, it is difficult to design experiments to determine what type of mechanisms are functioning in the cell. However, recent experiments with plateau-phase CHO cells clearly show that some of the simpler models are inadequate. Compared to a single high-dose-rate exposure, these cells show a much greater increase in survival as a result of dose protraction or fractionation, then from an extended post irradiation repair period. The magnitude of the difference is such that if the initial damage were all potentially lethal, some additional process such as an induced repair mechanism or concentration-dependent misrepair must e considered to account for it.

12724 **Evaluation of quiescent cells in the repair of radiation induced PLD in mammalian cells.** Keng, P.C.; Luk, C.; Sutherland, R.M. (Dept. of Radiation Biology and Biophysics and Cancer Center, Univ. of Rochester, Rochester, NY 14642). pp 135 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

The authors are investigating the role of quiescent cells in the repair of potentially lethal damage (PLD) after ionizing radiation. CHO, 9L, and EMT6 fed plateau phase cells were irradiated with 1.5 Krad /sup 137/Cs and incubated for 0,2,4,6,12 and 24 hr before cell survival assay. The percentage of quiescent cells under different experimental conditions were determined by flow cytometric analysis using acridine orange, BrdU+Hoechst, and anti-BrdU antibody staining methods. Continuous labelling with /sup 3/H-thymidine was used to confirm the flow cytometry results. Enriched populations of G/sub o/+G/sub 1/, S and G/sub 2/+M cells at different times after irradiation were isolated by centrifugal elutriation.

12725 **Indirect effects are involved in the production of potentially lethal damage in X irradiated escherichia coli.** Billen, D. (Univ. of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Div., Oak Ridge National Lab., Oak Ridge, TN 37830). pp 115 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

When living cells are exposed to low LET radiation, 60 to 70% of the resulting lethality is said to be due to indirect effects. Using the OH radical scavengers: glycerol n-butanol, t-butanol, and NO/sub 2//sup -/. The authors observed that a radiosensitive E. coli K-12 mutant (W 3110 thy/sup -/ polA1/sup -/) lacking DNA polymerase 1 displays a markedly enhanced radioresistance when exposed to X rays in the presence of these chemicals. The extent of protection afforded by these chemicals correlated with their OH radical scavenging ability over the limited range of concentrations of the chemicals studied. (Only non-toxic concentrations of the chemicals were used). The presence of 2M glycerol during irradiation of the PolA1/sup -/ cells results in a survival level higher than that seen for the unprotected parent strain (W 3110 thy polA/sup +/).

12726 **Tolerance of human spinal cord to high-energy p(66)Be(49) neutrons.** Cohen, L.; Haken, R.K.T.; Mansell, J.A.; Yalavarthi, D.; Hendrickson, F.R.; Awschalom, M. (Fermilab, Batavia, IL 60510). pp 138 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

A total of 76 patients with cancer of the head and neck have been irradiated at the Fermilab Neutron Therapy Facility using high-energy neutrons. Dose, time and cord-length factors were determined for each patient from their individual treatment plans. Cord doses ranged from 5 to 16 Gy in 8 to 24 fractions over 6 to 70 days. The treated lengths were between 5 and 15 cm. No myelopathy was seen during follow-up periods ranging from 2 to 6 years. By comparing these observations with published data, the upper and lower limits for spinal cord tolerance to neutrons can be determined. There is no apparent risk of injury with cord doses under 13 Gy.

12727 **Age dependent split dose recovery for radiogenic cancer in rat skin.** Burns, F.J.; Albert, R.E.; McMaster-Schuyler, L. (NYU Institute of Environmental Medicine, New York, NY 10016). pp 102 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

In view of the lower radiation-induced skin tumor yield in older rats, the authors investigated the split dose effect on carcinogenesis at different ages. The skin was irradiated with 0.8 MeV electrons as either single doses (800, 1200, 1600 rads surface dose) or 2 doses of 800 rads split by various times (.25, 2, 4, 8 and 24 hrs) at 3 ages (28, 113 and 182d). Skin tumors were scored as a function of time and the yields (tumors per rat) at 1 year were compared. The results for 28d old rats confirm previous results concerning the shape of the dose-response and magnitude of the repair halftime (3 hrs). At 113 days of age, the dose-response was slightly steeper than at 28d, and the repair half-time was reduced to between 1 and 2 hrs. At 182 days of age, the dose-response was steeper than at 113 days of age, and the repair halftime was reduced to less than 15 min. The results indicate that split dose repair relevant to carcinogenesis becomes more not less effective with increasing age.

12728 **Repopulation kinetics of rat rhabdomyosarcoma tumors following low- and high-let radiation.** Afzal, S.M.J.; Tenforde, T.S.; Curtis, S.B. (Biology and Medicine Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 110 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—). Contract AC03-76SF00098.

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Rat rhabdomyosarcoma tumors (the R2C5 subline) were irradiated in situ with 225-kVp X rays or with 557 MeV/μ neon ions in the distal position of a 4-cm extended peak. Twenty Gy of X rays and 7 Gy of peak neon ions were given to reduce the initial surviving fraction to 0.025, measured by the in vivo to in vitro plating technique. Groups of 5 to 6 tumors were excised and assayed for colony forming ability at 15 time points spanning a 3-week postirradiation period. With both radiation modalities, a significant decrease in the fraction of the clonogenic cell population of R2C5 tumors was observed 3 to 6 days after irradiation. Even 20 days following X irradiation, the fraction of clonogenic cells in the tumors did not reach that of unirradiated tumors of approximately the same volume. However, in tumors irradiated with peak neon ions, this fraction was reached by 18 days postirradiation. The rate of cell repopulation was consistent with the postirradiation tumor volume regression and regrowth pattern observed for both radiation modalities.

12729 **Radiobiology of ultrasoft x-rays.** Raju, M.R.; Carpenter, S.; Chmielewski, J.; Freyer, J.P.; Schillaci, M.; Wilder, M.E. (Los Alamos National Lab., Los Alamos, NM 87545). pp 121 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

The authors are taking advantage of the various sources of ultrasoft X-rays that are available at Los Alamos National Laboratory, because of research programs in plasma physics diagnostics, and of the unique flow cytometry instrumentation. The results of cell killing, under aerated and hypoxic conditions, and radiosensitivity as a function of cell cycle after exposure to Carbon K (0.28 KeV) and Aluminum K (1.5 Kev) x-rays are presented. X-rays from Copper K (8 KeV) were used as a reference radiation. These results indicate that while the ultrasoft X-rays are more effective in cell killing compared to 250 KVp X-rays, the variation of radiosensitivity, as a function of cell cycle, is found to be similar. From the results obtained so far, the oxygen enhancement ratio of ultrasoft X-rays appears to be less than that for Copper K X-rays.

12730 **Radiation effects on biological molecules: Influence of the local environment.** Nelson, W.H. (Georgia State Univ., Atlanta, GA 30303). pp 33 of Abstracts of papers for the thirty-second annual meeting of the Radiation Research Society. Philadelphia, PA; Radiation Research Society (1984). (CONF-8403123—).

From 32. annual scientific meeting of Radiation Research Society; Orlando, FL, USA (1 Mar 1984).

Because it crystallizes with several different molecular environments (e.g. hydrated, anhydrous, and HCl), and in several slightly modified molecular forms, the amino acid proline has been chosen as a probe of possible local effects on the radiation chemistry of biological molecules. In all systems studied so far (proline, proline/sup ./H/sub 2/O, proline /sup ./HCl, hydroxyl-proline, thioproline, and oxoproline), evidence for the "deamination" radical has been detected. This product, shown to arise from the primary carboxyl anion in hydroxyproline, is probably the result of electron attack in the other cases, also from the α-carbon. Evidence for the other products is currently under analysis and is discussed along with a summary of the results.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 12600, 12690

12731 **(CONF-8709156—2-Vugraphs) Discussion and description of a computerized safety data sheet system.** Satterwhite, C.J. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002329/JAW.

From Industrial hygiene training workshop - DOE trade; Arlington, VA, USA (21 Sep 1987).

Most of this report consists of viewgraphs from a presentation discussing a safety data base system. The data base provides the manufacturers' information on 1546 chemical compounds and is intended for health physics specialists. The system is menu-driven and can be accessed by off-site users. The document contains a glossary and a brief users' guide to the system. 39 refs. (TEM)

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 10772, 12441, 12452, 12488, 12507, 12513, 12541, 12609, 12611, 12689, 12690, 12702, 12703, 12718, 12723

12732 (AD-A—184815/9/XAB) Short-term in vitro screening studies related to the inhalation toxicology of potentially toxic aerosols. Final report, June 1984-April 1986. Grose, E.C.; Graham, J.A. (Environmental Protection Agency, Research Triangle Park, NC (USA). Inhalation Toxicology Div.). Aug 1987. 27p. NTIS, PC A03/MF A01.

The toxicity of JCE001 particles was tested using the rabbit alveolvar macrophage (RAM) test, hamster tracheal cultures and in vivo pulmonary bactericidal activity in mice. In the RAM test, incubation of alveolar macrophages (AM) with the JCE001 particles decreased AM viability, cellular adenosine 5' -triphosphate (ATP) and total protein levels. The lowest effective dose as determined by Williams' test was 50 ug/mL of JCE001 particles for all parameters examined. The presence of soluble cytotoxic components was established. The nature and rate of release of soluble toxic components from the JCE001 particles were important contributing factors in the mechanism by which these particles produced their toxic effects. A single 1-hr in vitro exposure of hamster tracheal ring organ cultures to the JCE001 particles was conducted to determine the dose response on ciliated respiratory epithelium. JCE001 particles caused a significant decrease in cilia beating frequency and an increase in cytopathological alterations. Morphological alterations in the tracheal epithelium were observed with light microscopy and scanning electron microscopy. The effect of the JCE001 particles on the ability of AM to kill inhaled pneumoniae was also measured. Bactericidal activity of all groups treated with the JCE001 particles was markedly reduced compared to that of controls.

12733 (CONF-880218—1) Scaling physiological pharmacokinetic models by physiological time. Ward, R.C.; Travis, C.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88000335/JAW.

From Society for Computer Simulation multiconference; San Diego, CA, USA (3 Feb 1988).

This paper shows that a multicompartment physiological pharmacokinetic model, used to account for inhalation exposure to volatile chlorohydrocarbons in mammalian species, can be made species-independent if chronological time is re-expressed in terms of physiological time. Physiological time is defined as chronological time divided by species body weight to the 1/4 power. We demonstrate the usefulness of this time scaling of the multicompartment physiological pharmacokinetic model by using it to model the inhalation of the volatile chlorinated hydrocarbon tetrachloroethylene in mice, rats, and humans. 8 refs., 2 figs.

12734 (CONF-8707130—1) In search of a phase response curve for lithium chloride. Readey, M.A.; Groh, K.R.; Ehret, C.F. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002925/JAW.

From 17. international conference on chronobiology; Leiden, Netherlands (12 Jul 1987).

Male rats were free-run, and one day later were exposed to a single, punctate dose of 5 mM LiCl/kg body weight by injection at one of eight equally spaced times throughout the 24-h period. For each of the six days following injection, a separate phase response curve was derived from core-temperature chronograms. Unlike the classical response induced by chronobiotics such as dexamethasone, alpha-methyl-para-tyrosine, and theophylline, statistically significant phase shifts for lithium were observed only on the first day following injection. These induced phase changes were not permanent, but instead were transient. By the sixth day of free-run, all experimental rats had drifted to the control acrophase; i.e., by the end of the experiment, most of the treated rats again had phase and confidence arcs not significantly different from their controls. The confidence arcs of the acrophases of the individual animals on the subsequent days post injection reveal that in this experiment, lithium was transiently dyschronogenic rather than definitively chronobiotic. The results suggest that punctate rather than chronic administration of lithium, followed by strict orthochronal administration of traditional zeitgebers, would be an effective way of restoring circadian synchrony in an internally desynchronized system. 122 refs.

12735 (CONF-8711101—1) Mouse germ cell mutation tests in genetic risk evaluation of chemical mutagens. Generoso, W.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002780/JAW.

From International mutagenesis workshop; Calcutta, India (14 Nov 1987).

The magnitude of genetic risk must be evaluated using results from various genetic test systems. Once it is determined that there exists potential, the evaluation process seeks: identification and quantification of the types of mutations expected, extrapolation of laboratory results to humans, estimation of the expected total contribution to the human genetic load, and estimation of the impact on society of the mutational increase expected. In practice, evaluation of genetic risk is likely to be carried out on a case-by-case basis and with many risk-related questions left unanswered. In this context, the case of two environmental mutagens is discussed with emphasis on mouse germ cell mutagenesis data. 10 refs.

12736 (DOE/ER—0343) DOE contractor's meeting on chemical toxicity. (USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research; Lawrence Livermore National Lab., CA (USA)). 1987. 203p. (CONF-8706206—Summs.). NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88000256/JAW.

From Department of Energy contractor's meeting on chemical toxicity; Monterey, CA, USA (23 Jun 1987).

The Office of Health and Environmental Research (OHER) is required to determine the potential health and environmental effects associated with energy production and use. To ensure appropriate communication among investigators and scientific disciplines that these research studies represent, OHER has sponsored workshops. This document provides a compilation of activities at the Third Annual DOE/OHER Workshop. This year's workshop was broadened to include all OHER activities identified as within the chemical effects area. The workshop consisted of eight sessions entitled Isolation and Detection of Toxic chemicals; Adduct Formation and Repair; Chemical Toxicity (Posters); Metabolism and Genotoxicity; Inhalation Toxicology; Gene Regulation; Metals Toxicity; and Biological Mechanisms. This document contains abstracts of the information presented by session.

12737 (DOE/EV/04746—34) Ionization in liquids: Final report, November 1, 1984-October 31, 1987. Bakale, G. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Radiology). 14 Dec 1987. Contract AC02-78EV04746. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004052/JAW.

The objectives of our research program were to study electron transport and reactions in model liquids and micellar and biological systems. Pulse-conductivity techniques were used to study physico-chemical effects on electron attachment and conduction and to measure carcinogen electron-attachment properties in liquids whereas the biological aspects of the proposed program were to be conducted through biological studies of radiation-induced damage to DNA with emphasis on the mechanism of the DNA-damage process. 130 refs., 1 tab.

12738 (FMPC—Sub-008-Vol.1) Characterization investigation study: Volume 1, Geophysical survey. Thatcher, B.K.; Phoenix, D.R. (Weston (Roy F.), Inc., West Chester, PA (USA)). Oct 1987. Contract AC05-86OR21600. 272p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88002956/JAW.

Geophysical surveys were conducted on portions of the Feed Materials Production Center to provide information on waste concentrations, shallow stratigraphy, and to identify locations potentially hazardous for drilling due to buried steel drums and tanks. Magnetic and electromagnetic terrain conductivity and ground penetrating radar surveys were conducted in the waste storage area, including pit nos. 1 through 4 and the burn pit, the sanitary landfill, and the south lime sludge pond. An additional ground penetrating

radar survey was performed along the slurry line to the K-65 silos. Electromagnetic terrain conductivity surveys were also performed at the slurry line, K-65 and metal oxide silos, upper and lower fly ash piles, southfield area, and along Paddy's Run and the storm sewer outfall ditch. 17 refs., 132 figs., 5 tabs.

12739 **(NP—8770033) Lead concentrations in human organs. An analytical/statistical investigation of deceased in Franconia.** Backhaus, W.W. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Medizinische Fakultaet). 28 Apr 1986. 37p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770033/JAW.

Tissue samples were taken from 10 defined points of 6 organs of 96 deceased persons (32 female, 64 male) aged between 22 and 88 who had died from early 1981 to mid-1981. The samples were compared with tissue samples from five organs of three newborns and one infant. Smoking habits of the deceased were found out, and occupational Pb exposure was excluded. The Pb concentration was lowest in the glottis (0.1 ppm TG) and highest in the liver (1.0). It increased from glottis, bladder, skeletal muscle, lungs to renal marrow, cortical substance and liver. In most cases, the concentration was higher by a factor 10 in the liver than in the glottis. There was no dependence on sex, age, and smoking habits. Correlations between Pb tissue and organ concentrations were high, especially in the paired organs, i.e. glottis, renal marrow and renal cortex. Standard deviations in men, women, smokers and non-smokers were similar in the different age groups. In the tissues from three newborns and one infant, Pb concentrations were between 0.01 and 0.1 ppm TG for all organs.

12740 **(ORNL—6383) Water quality criteria for colored smokes: Solvent Yellow 33, Final report.** Davidson, K.A.; Hovatter, P.S. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88002682/JAW.

The available data on the environmental fate, aquatic toxicity, and mammalian toxicity of Solvent Yellow 33, a quinoline dye used in colored smoke grenades, were reviewed. The US Environmental Protection Agency (USEPA) guidelines were used in an attempt to generate water quality criteria for the protection of aquatic life and its use and of human health. 87 refs., 2 figs., 13 tabs.

12741 **(PB—87-200275/XAB) Toxicity of 3400 chemicals to fish (Part 1). Toxicity of 1085 chemicals to fish (Part 2).** Wood, E.M.; Hollis, E.H.; Lennon, R.E. (Environmental Protection Agency, Washington, DC (USA). Office of Toxic Substances). Aug 1987. 277p. (EPA—560/6-87/002). NTIS, PC A13/MF A01.

The document, containing data on the toxicity of chemicals to fish, is in two parts. Part 1 consists of a 1953 study by E.M. Wood, U.S. Fish and Wildlife Service, Kearneysville, West Virginia. Data are compiled on over 3400 Chemicals (mostly organic compounds) which were tested using trout, bluegill, yellow perch, and goldfish, at a 5 mg/L screening concentration. Those compounds producing toxicity at 5 mg/L were tested further at lower concentrations. Part 2 contains data developed during a 1954 study by E.H. Hollis and R.E. Lennon at the Kearneysville laboratory using the same fish toxicity screening test protocols. Parts 1 and 2 are published here for the first time. These documents were prepared at the National Fisheries Research Center, U.S. Fish and Wildlife Service Laboratory, La Crosse, Wisconsin, from original records. A preface has been prepared by R.L. Lipnick, Office of Toxic substances, EPA, reviewing the use of these data in the development of structure-activity relationships and quantitative structure-activity relationships.

12742 **(PB—88-101050/XAB) Guidelines for the determination of halogenated dibenzo-p-dioxins and dibenzofurans in commercial products. Final report, March 1985-July 1986.** Steele, D.H.; Stanley, J.S. (Midwest Research Inst., Kansas City, MO (USA)). 19 Jun 1987. 126p. (MRI—8833-A01). NTIS, PC A07/MF A01.

The determination of halogenated dibenzo-p-dioxins (HDDs) and dibenzofurans (HDFs) in commercial products require specific and sensitive analytical procedures. The development of methods for the measurement of HDD and HDF in commercial products is complicated by the diverse range of matrices, the potentially large number of halogenated (specifically chloro, bromo, or bromo/chloro) HDD and HDF congeners and potential interference due to major components of the product matrices. This report provides: (1) a review of the literature pertaining to commercial product analyses for HDDs and HDFs; (2) detail on the total number of bromo, chloro, and bromo/chloro HDDs and HDFs; (3) a tentative scheme for the analysis of HDDs and HDFs in diverse matrices; and (4) guidelines for the high-resolution gas chromatography/mass spectrometry or electron capture detector analysis of commercial products for HDDs and HDFs. The guidelines specify a rigorous OA/QC program for the analysis of the commercial products.

12743 **(PB—88-101662/XAB) Effects of acid rain on grapevines.** Forsline, P.L.; Musselman, R.C.; Dee, R.J.; Kender, W.J. (New York State Agricultural Experiment Station, Geneva (USA). Dept. of Pomology and Viticulture). 1983. 8p. NTIS, PC A02/MF A01.

Pub. in American Jnl. of Enology and Viticulture, Vol. 34, No. 1, 17-22(Jan 1983).

Mature vineyard-growing Concord grapevines were sprayed with simulated acid rain solutions ranging from pH 2.5 to 5.5 both as acute treatments at anthesis and chronically throughout the season in 1980 and 1981. In 1981, 8 additional varieties were also treated with simulated acid rain solutions at pH 2.75 and 3.25. With Concord in 1981, few foliar lesions on leaves were visible at pH 2.75. In contrast, many leaf lesions with decreased fruit soluble solids were observed at pH 2.5 in 1980. The relationship between acid-rain and oxidant stipple, chlorosis, and soluble solids in the absence of acid rain leaf lesions at pH>2.5 remains unclear. Acute sprays (pH2.75) at anthesis reduced pollen germination in four grape cultivars. However, fruit set was reduced in only one of these. Grape yields were not influenced by acid rain treatments. There was no evidence that acid-rain at ambient pH levels had negative effects on grape production or fruit quality.

12744 **(PB—88-102744/XAB) Health and Environmental Effects Profile for 1,3-butadiene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1983. 53p. (EPA—600/X-84/120). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for 1,3-butadiene was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous-waste constituents. Quantitative estimates are presented, provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic potency factor for 1,3-butadiene.

12745 **(PB—88-103148/XAB) Electrophysiological assessment of sensory and cognitive function in children exposed to lead: a review.** Otto, D.A. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1987. 25p. (EPA—600/D-87/296). NTIS, PC A03/MF A01.

Studies of the effects of lead absorption on sensory evoked and slow brain potentials in children are reviewed. Studies of slow-wave voltage in children during sensory conditioning indicated a linear relationship to blood lead level in two studies; an effect that could not be replicated in an independent sample of children. Results of a fourth study indicated that slow-voltage measures were more sensitive to lead during active rather than passive conditioning. Conflicting evidence of lead effects on pattern-reversal visual evoked potentials in children was found in three studies. Evidence of increased latencies of brainstorm auditory evoked potentials at blood lead levels above 25/dl were reported in two studies. Sensory evoked potentials hold considerable promise as noninvasive, clinically valid, culture-free measures of the effects of lead exposure on sensory-nerve conduction, but further study is needed in humans and animals to clarify inconsistencies in the existing literature.

12746 (PB—88-103783/XAB) Health and environmental effects profile for n-propyl alcohol. (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1983. 41p. (EPA—600/X-84/116). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for n-propyl alcohol was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous waste constituents. Quantitative estimates are presented, provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic potency factor for n-propyl alcohol.

12747 (PB—88-103833/XAB) Health and environmental effects profile for tetra-, penta- and hexachlorodibenzo-p-dioxins. (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Aug 1984. 222p. (EPA—600/X-84/115). NTIS, PC A10/MF A01.

The Health and Environmental Effects Profile for Tetra-, Penta- and Hexachloro-dibenzo-p-dioxins was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous waste constituents. Quantitative estimates are presented, provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic potency factor for tetra-, penta- and hexachlorodibenzo-p-dioxins.

12748 (PB—88-104203/XAB) Cumulative exposure to arsenic and its relationship to respiratory cancer among copper-smelter employees. Lee-Feldstein, A. (Michigan Univ., Ann Arbor (USA). School of Public Health). 1986. 9p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Occupational Medicine, Vol. 28, No. 4, 296-302(Apr 1986).

To explore the role of arsenic as a human carcinogen, the respiratory cancer-mortality experience (1938 to 1977) of 8045 white-male smelter employees in Montana was examined relative to cumulative exposure to arsenic trioxide and was compared with that of the white male population of the same region. Exposure to arsenic was estimated for various work areas from industrial-hygiene reports of average concentrations present in the smelter. Respiratory cancer mortality was analyzed further by time period of first employment and maximum lifetime exposure to arsenic trioxide. When exposure was estimated with arithmetic means of measured concentrations among men first employed prior to 1925, respiratory cancer mortality increased linearly with increasing cumulative exposure group, ranging from two to nine times expected; among those first employed in the period 1925 to 1947 it also increased linearly with increasing cumulative exposure group.

12749 (PB—88-105929/XAB) Health and Environmental Effects Profile for monochlorobutanes. (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1983. 36p. (EPA—600/X-84/117). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for Monochlorobutanes was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous-waste constituents. Quantitative estimates are presented, provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic potency factor for monochlorobutanes.

12750 (PB—88-105937/XAB) Health and Environmental Effects Profile for 4-vinyl-1-cyclohexene. (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1983. 27p. (EPA—600/X-84/113). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for 4-vinyl-1-cyclohexene was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous waste constituents. Quantitative estimates are presented, provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic potency factor for 4-vinyl-1-cyclohexene.

12751 (PB—88-107008/XAB) Health and environmental effects profile for tetra-, penta-, and hexachlorodibenzofurans. (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Mar 1983. 60p. (EPA—600/X-84/114). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for tetra-, penta- and hexachlorodibenzofurans was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic factor for tetra-, penta- and hexachlorodibenzofurans.

12752 (PB—88-107107/XAB) Ozone-induced ethylene release from leaf surfaces. Rodecap, K.D.; Tingey, D.T. (Northrop Services, Inc., Corvallis, OR (USA)). 1986. 6p. (EPA—600/J-86/398). NTIS, PC A02/MF A01.

Pub. in Plant Science, Vol. 44, 73-76(Mar 1986).

Ozone-induced stress-ethylene emissions from the adaxial and abaxial leaf surfaces of four plant species (Glycine max (L) Merr. cv. Dare, Lycopersicon esculentum Mill cv. Roma VF, Eucalyptus globulus Labill. and Hedera helix L.) were studied to determine if the stress ethylene diffused through the stomata or cuticle. In plants not exposed to ozone, basal ethylene was detected above both the adaxial and abaxial leaf surfaces of all the plant species examined, indicating that some ethylene can diffuse across the leaf cuticle. Ozone-induced stress ethylene production in all species examined. These data indicate that ozone-induced stress ethylene primarily diffuses from the leaf via the stomata.

12753 (PB—88-107198/XAB) Effects of copper, nickel, and zinc on three species of Oregon freshwater snails. Nebeker, A.V.; Stinchfield, A.; Savonen, C.; Chapman, G.A. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). 1986. 7p. (EPA—600/J-86/407). NTIS, PC A02/MF A01.

Pub. in Environmental Toxicology and Chemistry, Vol. 5, 807-811(May 1986).

Three snail species collected from western Oregon were exposed to metals - Juga plicifera and Lithoglyphus virens, which inhabit cool coastal streams, and Physa gyrina, which is found in Willamette Valley ponds. J. plicifera were exposed in flow-through laboratory tests to copper and nickel, L. virens were exposed to copper, and P. gyrina were exposed to nickel and zinc. J. plicifera

has a 96-h LC50 (50% of the test group died) of 0.015 mg/L for copper and a no observed effect level (NOEL, mortality not significantly different from that in control groups) of 0.006 mg/L (30-d survival). J. plicifera had a 96-h LC50 for nickel of 0.237 mg/L and a NOEL of 0.124 mg/L. L. virens had a 96-h LC50 for copper of 0.008 mg/L and a NOEL of less than 0.008 mg/L. P. gyrina had a 96-h LC50 for nickel of 0.239 mg/L, a 96-h LC50 for zinc of 1.274 mg/L and a NOEL for zinc of 0.570 mg/L.

12754 **(PB—88-107511/XAB) Health and Environmental Effects Profile for 2-chloro-1,3-butadiene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Dec 1983. 56p. (EPA—600/X-84/112). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for 2-chloro-1,3-butadiene was prepared by the Office of Health and Environmental Assessment, Environmental criteria assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potenial human health, aquatic life and environmental effects of hazardous waste constituents. Quantitative estimates have been presented provided sufficient data are available. 2-Chloro-1,3-Butadiene has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for 2 Chloro-1,3-Butadiene is 1.9x10-3 mg/kg bw/day for oral exposure.

12755 **(PB—88-107537/XAB) Genetic activity profiles of some chemicals found in hazardous wastes.** Waters, M.D.; Stack, H.F.; Brady, A.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1987. 24p. (EPA—600/D-87/300). NTIS, PC A03/MF A01.

A methodology was developed to display and evaluate multiple test quantitative information on genetic toxicants. Dose information is collected from the open literature. Genetic activity profiles were prepared for the use of the International Agency for Research on Cancer (IARC) Working Group on Monographs Supplement 6, Chemicals, Industrial Processes and Industries Associated with Cancer in Humans. These profiles will constitute a quantitative data base on the genetic and related effects of approximately 200 chemicals for which some data are available on carcinogenicity in humans. The information will be useful for purposes of comparative chemical assessment and should directly facilitate evaluation of genotoxic chemicals associated with hazardous wastes. Some 34 of the agents reviewed by the IARC are among 100 that have been listed for development of toxicological profiles under the U.S. Superfund Amendments and Reauthorization Act (SARA) of 1986. Genetic toxicity data on an additional seven chemicals listed under SARA are provided in the report.

12756 **(PB—88-107800/XAB) Health and Environmental Effects Profile for chloropropenes.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1983. 50p. (EPA—600/X-84/119). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for chloropropenes was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous waste constituents. Quantitative estimates are presented, provided sufficient data are available. Chloropropenes were determined to be systemic toxicants. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for 3-chloropropene is .0016, 1,2,3-trichloropropene is .0046 for oral exposure. Existing data are insufficient to determine for the other isomers.

12757 **(PB—88-109665/XAB) Comparisons of the pathogenicity of long and short fibres of chrysotile asbestos in rats.** Davis, J.M.G.; Jones, A.D.; Smith, T. (Institute of Occupational Medicine, Edinburgh (UK)). Jun 1987. 59p. (TM—87/08). NTIS, PC E06/MF E06.

While previous studies have suggested that the harmful potential of very-short-fiber chrysotile is much less than that of chrysotile dust containing long fibers, intratracheal injection is an abnormal technique which bypasses the normal pulmonary-clearance mechanisms. In order to investigate the fibrogenic and carcinogenic potential of any fiber sample in normal situations, inhalation studies are necessary. This report describes long-term inhalation and injection studies sponsored by the Institute for Research and Development on Asbestos. In these experiments, rats were exposed to either the short-fiber chrysotile preparation or to a dust cloud generated from the same batch of raw chrysotile in such a way as to produce the highest possible proportion of long fibers.

12758 **(PB—88-853734/XAB) Toxicity of food additives (excluding antioxidants). January 1978-November 1987 (citations from the Life Sciences Collection data base). Report for January 1978-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 156p. NTISPC N01/MF N01.

Supersedes PB—86-854874.

This bibliography contains citations concerning the toxicity of food additives (excluding antioxidants) and their effects on the liver, kidneys, bladder, and other organs. The carcinogenic and teratogenic properties of these substances are also considered. The synthetic sweeteners, particularly the saccharins and cyclamates, and other additives, including nitrates and nitrites are discussed. Methods to detect and quantitate these additives are also included. (This updated bibliography contains 340 citations, 132 of which are new entries to the previous edition.)

12759 **(PNL—6412) Inhalation developmental toxicology studies: Teratology study of 1,3-butadiene in mice: Final report.** Hackett, P.L.; Sikov, M.R.; Mast, T.J.; Brown, M.G.; Buschbom, R.L.; Clark, M.L.; Decker, J.R.; Evanoff, J.J.; Rommereim, R.L.; Rowe, S.E. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88004187/JAW.

Maternal toxicity, reproductive performance and developmental toxicology were evaluated in CD-1 mice following whole-body, inhalation exposures to 0, 40, 200 and 1000 ppM of 1,3-butadiene. The female mice, which had mated with unexposed males were exposed to the chemical for 6 hours/day on 6 through 15 dg and sacrificed on 18 dg. Maternal animals were weighed prior to mating and on 0, 6, 11 and 18 dg; the mice were observed for mortality, morbidity and signs of toxicity during exposure and examined for gross tissue abnormalities at necropsy. Live fetuses were weighed and subjected to external, visceral and skeletal examinations to detect growth retardation and morphologic anomalies. Significant concentration-related decreases were detected in a number of maternal body weight measures. There was a significant concentration-related depression of fetal body weights and placental weights. Body weights of male fetuses of all exposed groups were significantly lower than values for control fetuses; weights of female fetuses were significantly depressed in the mice exposed to 200 and 1000 ppM. In the 200- and 1000-ppM exposure groups, weights of placentas of male fetuses were significantly decreased, but placental weights of female fetuses were significantly affected only in litters exposed to the highest 1,3-butadiene concentration. This exposure regimen produced significant signs of maternal toxicity at concentrations of 200 and 1000 ppM 1,3-butadiene.

12760 **(PNL—6414) Inhalation developmental toxicology studies of 1,3-butadiene in the rat: Final report.** Hackett, P.L.; Sikov, M.R.; Mast, T.J.; Brown, M.G.; Buschbom, R.L.; Clark, M.L.; Decker, J.R.; Evanoff, J.J.; Rommereim, R.L.; Rowe, S.E. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88004186/JAW.

Maternal toxicity, reproductive performance and developmental toxicology were evaluated in Sprague-Dawley-derived rats during and following 6 hours/day, whole-body, inhalation exposures to 0, 40, 200, and 1000 ppM of 1,3-butadiene. The female rats (Ns = 24 to 28), which had mated with unexposed males, were exposed to the chemical from 6 through 15 dg and sacrificed on 20 dg. Maternal animals were weighed prior to mating and on 0, 6, 11, 16 and 20 dg; the rats were observed for mortality, morbidity and signs of toxicity during exposure and examined for gross tissue abnormalities at necropsy. Live fetuses were weighed and subjected to external, visceral and skeletal examinations to detect growth retardation and morphologic anomalies. There were no significant differences among treatment groups in maternal body weights or extragestational weights of rats exposed to 1,3-butadiene concentrations of 40 or 200 ppM, but, in animals exposed to 1000 ppM, significantly depressed body weight gains were observed during the first 5 days of exposure and extragestational weight gains tended to be lower than control values. These results, and the absence of clinical signs of toxicity, were considered to indicate that there was no maternal toxicity at exposure levels of 200 ppM or lower. The percentage of pregnant animals and the number of litters with live fetuses were unaffected by treatment. Under the conditions of this exposure regimen, there was no evidence for a teratogenic response to 1,3-butadiene exposure.

12761 **Poly(gamma-glutamylcysteinyl)glycine: its role in cadmium resistance in plant cells.** Jackson, P.J.; Unkefer, C.J.; Doolen, J.A.; Watt, K.; Robinson, N.J. (Los Alamos National Lab., NM). *Proceedings of the National Academy of Sciences of the United States of America;* **84**: No. 19, 6619-6623(Oct 1987).

Angiosperms can be selected for the ability to grow in the presence of normally toxic concentrations of certain trace metal ions. Addition of Cd and Cu to Cd-resistant Datura innoxia cell cultures results in the rapid synthesis and accumulation of sulfur-rich, metal-binding polypeptides. The structure of these compounds was determined using amino acid analysis, ^{13}C NMR, and site-specific enzymic digestion. These compounds are poly(gamma-glutamylcysteinyl)glycines. Greater than 80% of the cellular Cd is bound to the bis and tris forms in Cd-resistant cells. There is a direct correlation between the maximum accumulation of the metal-binding polypeptides and the concentration of toxic ions to which the cells are resistant. In the presence of metal ions, the polypeptides form multimeric aggregates that can be resolved by gel chromatography. Cd binds to both the high and low molecular weight aggregates, whereas Cu preferentially binds to the higher molecular weight forms. The presence of gamma-carboxamide linkages between glutamyl and adjacent cysteinyl residues indicates that these polypeptides are products of biosynthetic pathways. Poly(gamma-glutamylcysteinyl)glycines bind metals and, in this respect, appear to be functional analogs of the protein metallothionein. However, in the absence of supraoptimal concentrations of trace metal ions, the functions of metallothionein in animals and microorganisms and poly(gamma-glutamylcysteinyl)glycines in plants may differ.

12762 **Polymerization of phenols catalyzed by peroxidase in nonaqueous media.** Dordick, J.S.; Marletta, M.A.; Klibanov, A.M. (Massachusetts Institute of Technology, Cambridge). *Biotechnology and Bioengineering;* **30**: No. 1, 31-36(1987).

Polymers produced by horseradish-peroxidase-catalyzed coupling of phenols have been explored as potential substitutes for phenol-formaldehyde resins. To overcome low substrate solubilities and product molecular weights in water, enzymatic polymerizations in aqueous-organic mixtures have been examined. Peroxidase vigorously polymerizes a number of phenols in mixtures of water with water-miscible solvents such as dioxane, acetone, dimethylformamide, and methyl formate with the solvent content up to 95%. As a result, various phenolic polymers with average molecular weights from 400 to 2.6×10^4 D were obtained depending on the reaction medium composition and the nature of the phenol. Peroxidase-catalyzed copolymerization of different phenols in 85% dioxane was demonstrated. Poly(p-phenylphenol) and poly(p-cresol) were enzymatically prepared on a gram scale. They had much higher melting points, and in addition, poly(p-phenylphenol) was found to have a much higher electrical conductivity than phenol-formaldehyde resins.

12763 **Dynamics of a biological fixed film for phenol degradation in a fluidized-bed bioreactor.** Worden, R.M.; Donaldson, T.L. (Univ. of Tennessee, Knoxville). *Biotechnology and Bioengineering;* **30**: No. 3, 398-412(1987). Contract AC05-84OR21400.

Experimental and modeling studies were conducted to analyze the dynamic response behavior of a phenol-oxidizing fixed film using a differential, fluidized-bed bioreactor in a recycle loop with a well-mixed reservoir. With the bioreactor at steady state, a pulse of phenol was added to perturb the system, and the phenol concentration was monitored continuously until steady state was again achieved. The experimental dynamics were compared with a dynamic mathematical model based on diffusion and reaction within the biofilm, liquid mixing, and biofilm growth. Constant-pH experiments could be adequately described using an unstructured, double-Monod kinetic expression with substrate inhibition by phenol. However, in dynamic experiments without pH control, the pH of the liquid phase dropped, and damped oscillations were observed in the phenol concentration and reaction rate trajectories. Oscillatory solutions could not be included in the model, even when product inhibition was included, and a linear stability analysis did not reveal tendencies toward instability. The cause of the experimental oscillations remains unknown.

12764 **Production of chelating agents by Pseudomonas aeruginosa grown in the presence of thorium and uranium.** Premuzic, E.T.; Lin, M.; Francis, A.J.; Schubert, J. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY 11973). pp 391-397 of Speciation of fission and activation products in the environment. Bulman, R.A.; Cooper, J.R. New York, NY; Elsevier Science Pub. Co. Inc. (1985). (CONF-850473—).

From Seminar on the speciation of fission and activation products in the environment; Oxford, UK (16 Apr 1985).

Chelating agents produced by microorganisms enhance the dissolution of iron increasing the mobility and bioavailability of the metal. Since some similarities exist in the biological behavior of ferric, thorium and uranyl ions, microorganisms resistant to these metals and which grow in their presence may produce sequestering agents of Th and U, and other metals in a manner similar to the complexation of iron by siderophores. The ability of P. aeruginosa to elaborate sequestering agents in medium containing thorium or uranium salts was tested. Addition of 10, 100, and 1000 ppm of uranium or thorium to culture medium increased the lag period of the organism as the concentration of the metal increased. At concentrations of 1000 ppm and higher, there was an extended lag period followed by reduction in growth. Uranium has a stronger inhibitory effect on growth of the organism than thorium at similar concentrations. Analyses of the culture media have shown, that relative to the control, and under the experimental conditions used, the microorganisms have produced several new chelating agents for thorium and uranium. Extracts containing these chelating agents for their decorporation potential. In vitro mouse liver bioassay and in vivo mouse toxicity tests indicate that their efficiency is comparable to DTPA (Diethylenetriaminepentaacetic acid) and DFOA (Desferrioxamine) and that they are virtually non-toxic to mice. The bacterially produced compounds resemble, but are not identical to the known iron chelating siderophores isolated from microorganisms. Some of their chemical properties are also discussed.

5604 Other Environmental Pollutant Effects

12765 **(AD-A—185271/4/XAB) Radiofrequency radiation and cellular secretory processes. Final report, February 1983-December 1985.** Albert, E.N.; Slaby, F. (George Washington Univ. Medical Center, Washington, DC (USA). Dept. of Anatomy). Aug 1987. 35p. NTIS, PC A03/MF A01.

The purpose of this study was to investigate the effect of unmodulated 915-MHz radiation on the secretory processes of exocrine and endocrine cells under in vitro conditions. Pancreatic tissue slices were exposed to 915-MHz radiation in a Crawford-cell exposure system. Sham-exposed slices were either incubated at 37 or 40 C. These slices were pulse-labeled with tritiated L-leucine and the labeled secretory proteins were determined by autoradiography and counting of silver grains. In another experiment, amy-

lase secretion from exposed and sham-exposed pancreatic slices was determined. The results suggest that radiation exposure can alter exocrine and endocrine secretions under conditions where the microwave energy produced hyperthermia in localized areas.

12766 **(CONF-8703216—) Current problems of the effect of electromagnetic fields on human beings.** (Schweizerischer Elektrotechnischer Verein, Zurich). 1987. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751247/JAW.

From Information meeting on current problems of the effect of electromagnetic fields on human beings; Zurich, Switzerland (5 Mar 1987).

These proceedings contain the full text of the 7 lectures given at the meeting. Four lectures are concerned with the effect of electrical and magnetic fields or electrical currents on human beings and the effects on the skin and the internal organs, and also on possible limiting values for exposure. Two lectures are concerned with core spin tomography in medical diagnosis, one of them with the energy deposition in tissues to be expected in this process. One lecture has as its subject the disturbance of heart pacemakers by electromagnetic fields.

12767 **(OH/R—87/50/K) A magnetic field exposure monitor.** Kuurstra, J.C. (Ontario Hydro Research Div., Toronto (Canada)). 24 Feb 1987. 7p. (MICROLOG—87-04873). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A pocket-sized Magnetic Field Exposure Monitor has been developed to measure and record the level of 60-Hz magnetic fields to which electrical utility workers are exposed. It can monitor the magnetic field strength for periods of up to one work week, storing the average magnetic field level every minute. The data can then be transferred to a computer for display, analysis, and long term storage.

12768 **(PB—88-853767/XAB) Seafarer: impacts and studies of the extremely-low-frequency communication system. January 1970-November 1987 (citations from the NTIS data base). Report for January 1970-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 99p. NTISPC N01/MF N01.

Supersedes PB—86-857778.

This bibliography contains citations concerning the Department of the Navy global communication system using extremely low frequency (ELF) radio waves. This system is known as Seafarer and was previously called Sanguine. Topics include biological effects of ELF radiation on humans, animals and plants, system descriptions and feasibility studies. Specific surveys for antenna system location in Wisconsin, Michigan, and Texas are treated. (This updated bibliography contains 206 citations, 15 of which are new entries to the previous edition.)

12769 **Developmental studies of Hanford miniature swine exposed to 60-Hz electric fields.** Sikov, M.R.; Rommereim, D.N.; Beamer, J.L.; Buschbom, R.L.; Kaune, W.T.; Phillips, R.D. (Pacific Northwest Labs., Richland, WA). *Bioelectromagnetics (New York);* 8: No. 3, 229-242(1987).

Evaluations of reproductive and developmental toxicology, including teratology, were included as part of a broad screening study in Hanford Miniature swine (HMS) to detect effects of exposure to electric fields. One group (E) was exposed to a uniform, vertical, 60-Hz, 30-kV/m electric field for 20 h/day, 7 days/week; sham-exposed (SE) swine were housed in a separate, environmentally equivalent building. The first generation (F0) gilts were bred after 4 months of study; some were killed for teratologic assays at 100 days of gestation (dg), and the others produced an F1 generation of offspring. The pooled incidence of terata in these litters (teratologic assays and live births) was similar in the E and SE groups. The F0 females, which produced the F1 generation, were bred again after 18 months of exposure and were killed at 100 dg. Malformation incidence in E litters (75%) was significantly greater than in SE litters (29%). No consistent differences in litter size, fetal mass, or mass of fetal organs were detected. The F1 gilts were bred at 18 months of age; defective offspring were found in significantly more of the E litters (71%) than in SE litters (33%). These F1 females were bred again 10 months later and teratologic assays were performed on their second litters at 100 dg. The percentage of litters with malformed fetuses was essentially identical in the E and SE groups (70% and 73%, respectively). There appears to be an association between chronic exposure to a strong electric field and developmental effects in swine, although the change in incidence of malformations between generations and between the first and second breedings makes it impossible to conclude unequivocally that there is a cause-and-effect relation.

12770 **Reproduction and development in rats chronologically exposed to 60-Hz electric fields.** Rommereim, D.N.; Kaune, W.T.; Buschbom, R.L.; Phillips, R.D.; Sikov, M.R. (Pacific Northwest Labs., Richland, WA). *Bioelectromagnetics (New York);* 8: No. 3, 243-258(1987).

Previous studies have raised the possibility of reproductive and developmental changes in miniature swine chronically exposed to a strong 60-Hz electric field. Two replicate experiments on rats were performed to determine if similar changes could be detected in animals exposed under a comparable regime, which was based on average, induced-current densities and on the chronology of reproductive development, as dosimetrically and biologically scaled. Beginning at three months of age, female rats of the F0 generation and their subsequent offspring were chronically exposed to a 60-Hz electric field (100 kV/m unperturbed) for 19 h/day for the duration of experimentation. After four weeks of exposure, F0 female rats were mated to unexposed male rats during the field-off period. No significant developmental effects were detected in their litters, confirming our previous results with swine and rats. The F0 females were mated for a second time at 7.2 months of age, and the fetuses were evaluated shortly before term. In the first experiments, the incidence of intrauterine mortality was significantly less in exposed than in sham-exposed litters, and there was a tendency ($P = .12$) for an increased incidence of malformed fetuses in exposed litters. Neither end point was significantly affected in the second experiment. Copulatory behavior of the female F1 offspring, which were bred at three months of age, was not affected in either experiment. There was a statistically significant decrease in the fertility of F1 exposed females and a significant increase in the fraction of exposed litters with malformed fetuses in the first experiment; both end points were essentially the same in the sham and exposed groups of the second experiment. That the significant effects detected in the first experiment were not seen in the second may be attributed to random or biological variation.

57 Health And Safety

REFER ALSO TO CITATION(S) 11619, 11620, 11631, 12615, 12738

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 11624

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 11003, 12422, 12423

5802 Geophysics

REFER ALSO TO CITATION(S) 12410, 12440

12771 **(AD-A—185232/6/XAB) Effects of band-limited white-noise excitation on liquefaction potential in large-scale tests. Master's thesis.** Jasinski, D.L. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1987. 154p. (AFIT/CI/NR—87-58T). NTIS, PC A08/MF A01.

During earthquakes, ground movement can cause soils to lose strength or stiffness resulting in structures settling and embankments sliding. A phenomenon contributing to this loss in strength

and subsequent failures is called soil liquefaction. This title, however, does not refer to a single well-defined event, but rather to a complex set of interrelated phenomena which contribute to the occurrence of damage and and failures during an earthquake. Numerous investigators have tried to model and predict the potential and probability of liquefaction occurring in soils. Since the early 1960's considerable attention has been given to the development of laboratory testing procedures to provide improved methods of characterizing the liquefaction properties of soils. Various test apparatus have been designed or modified in an attempt to provide an accurate representation of the stress state generated in-situ by earthquakes. To this end a number of experimental devices, including the cyclic triaxial and cyclic simple shear, with repeatable representation of conditions in-situ during an actual earthquake are discussed.

12772 **(YJT—87-08) Utilisation of the refraction seismic method.** Okko, O. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). May 1987. 43p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751323/JAW.

Seismic refraction surveys have been carried out in the same traditional way since the 1950's. The development of seismics has been concentrated in improvement of the data processing techniques. The latest advance in the refraction method is the Generalised Reciprocal Method, GRM, developed in Australia during the last decade. The new method is actually a widening of the well-known ABC-method. The GRM-method makes it easier to determine the origins in soil layers or in the bedrock of the velocity anomalies found in refraction data. A FORTRAN-77 program is implemented on IBM-PC to calculate the time-depths and velocity analyses of the GRM-method. A FFT-routine needed in the wave form analysis is also programmed. These codes as well as plotting routines written in BASIC can be obtained from the Geotechnical Laboratory of the Technical Research Centre of Finland. In the traditional refraction survey only the first arrival of the elastic waves has been measured. Seismographs used in these surveys have usually an analog output on paper. Only two digital seismographs have been used in Finland, but at least three new digital systems will be bought this year. Digital seismographs are able to record the whole wave form, which gives the possibility to analyse also later arrivals. Examples from abroad show that the the quality of shallow bedrock can be interpreted quantitatively when the attenuation of the waves is studied. The bedrock reflection can also be recorded in digital seismograms. The integration of the refraction and reflection methods will increase the accuracy of the shallow seismic method significantly. In discussion with the interpreters of main Finnish companies running seismic surveys the most common problems met in the praxis and the needs for development work to improve the interpretation of digital refraction data were mapped.

12773 **Air pressure waves from Mount St. Helens eruptions.** Reed, J.W. (Sandia National Laboratories, Albuquerque, New Mexico). *Journal of Geophysical Research;* **92**: No. D10, 11979-11992(20 Oct 1987).

Weather station barograph records as well as infrasonic recordings of the pressure wave from the Mount St. Helens eruption of May 18, 1980, have been used to estimate an equivalent explosion airblast yield for this event. Pressure amplitude versus distance patterns in various directions compared with patterns from other large explosions, such as atmospheric nuclear tests, the Krakatoa eruption, and the Tunguska comet impact, indicate that the wave came from an explosion equivalent of a few megatons of TNT. The extent of tree blowdown is considerably greater than could be expected from such an explosion, and the observed forest damage is attributed to outflow of volcanic material. The pressure-time signature obtained at Toledo, Washington, showed a long, 13-min duration negative phase as well as a second, hour-long compression phase, both probably caused by ejecta dynamics rather than standard explosion wave phenomenology. The peculiar audibility pattern, with the blast being heard only at ranges beyond about 100 km, is explicable by finite amplitude propagation effects. Near the source, compression was slow, taking more than a second but probably less than 5 s, so that it went unnoticed by human ears and susceptible buildings were not damaged. There was no damage as Toledo (54 km), where the recorded amplitude would have broken windows with a fast compression. An explanation is that wave emissions at high elevation angles traveled to the upper stratosphere, where low ambient air pressures caused this energetic pressure oscillation to form a shock wave with rapid, nearly instantaneous compression. Atmospheric refraction then returned part of this wave to ground level at long ranges, where the fast compressions were clearly audible. copyright American Geophysical Union 1987

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 10834, 11003, 12190, 12560, 12561

12774 **(OH/R—86/351/K) Stress effects on deformation modulus and dilatometer sensitivity.** Koopmans, R.; Hughes, R.W. (Ontario Hydro Research Div., Toronto (Canada)). 17 Feb 1987. 23p. (MICROLOG—87-04881). Ontario Hydro Research Division, Editorial Section, 700 University Ave., Toronto, Ont., Canada M5G 1X6; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report investigates the effect of various stress levels on the determination of deformation moduli and examines the sensitivity of the borehole dilatometer in measuring rock mass scale features. Results indicate that the deformation modulus of a rock mass can be substantially affected by the stress field and that the dilatometer is sensitive enough to profile deformation moduli as dictated by rock mass characteristics. 11 figs., 1 tab.

12775 **Behavior of a wide opening in a deep potash mine: A case history.** Hambley, D.F.; Mraz, D.Z. (Argonne National Lab., IL). pp 883-892 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—). Contract W-31-109-ENG-38.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

This paper presents the case history of a monitored opening 4.5 m high by 42 wide in a deep potash mine. Deformations and stresses were measured in the roof and a wall. From the monitoring data, the geometry of the active opening and viscoplastic zone was determined and compared with predicted values. Reasonable agreement between measured and predicted values was obtained. Using the data, the projected mining layout of relatively thick pillars with viscoelastic zones was evaluated and found to be satisfactory.

12776 **Pseudostrain representation of multipass excavations in salt.** Munson, D.E.; Torres, T.M.; Jones, R.L. (Sandia National Labs., Albuquerque, NM). pp 853-862 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Early-time mining sequence closure displacements show how effects of multipass excavations are accommodated in bedded salt.

12777 **Seismic visibility of fractures.** Pyrak-Nolte, L.J.; Myer, L.R.; Cook, N.G.W. (Dept. of Material Science and Mineral Engineering, Univ. of California, Berkeley, CA). pp 47-56 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Laboratory measurements of seismic travel times of compressional waves, propagated through both intact and naturally fractured specimens of quartz monzonite, were used to determine velocities of propagation. Velocities calculated from a quasi-static model were found to be too low compared to the measured velocities. A theoretical velocity is derived, based on the displacement discontinuity model of wave propagation across a fracture, which depends on the dynamic stiffness of the fracture and on frequency. Comparisons of the measured velocities and those computed from the theory agreed, and confirm the appropriateness of the displace-

ment discontinuity model to simulate wave propagation across the fracture.

12778 **Microcomputer control of triaxial rock compaction and creep tests.** Hardikar, M.A.; Fahrenthold, E.P.; Gray, K.E. (Center for Earth Sciences and Engineering, Univ. of Texas, Austin, TX). pp 117-124 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The conduct of triaxial compaction and creep tests on porous rock requires the precise adjustment of mechanical and pore pressure loads over predetermined paths in stress space, and in response to sample deformations. In the case of creep tests, these adjustments must occur continuously over periods up to months in duration. This paper describes the development and functioning of software written to control rock compaction and creep tests using a standard microcomputer based on the Intel 80286 microprocessor and employing a UNIX-like operating system.

12779 **Fracture mechanics modeling associated with layered rock and bi-material interfaces.** Advani, S.H.; Lee, J.K.; Lee, T.S.; Jinn, J.T.; Choudhry, S. (The Ohio State Univ., Columbus). pp 375-382 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Finite element investigations of fracture propagation in layered rock are conducted. Evaluations of an applied phenomenological model for studying crack growth in composite materials are presented for supplementary comparisons and trend verification. The effects of friction across interfaces are demonstrated by using an elastic contact algorithm. The general applicability of the reported results to hydraulic fracture geometry prediction and design is discussed.

12780 **Strength and microfracturing of Westerly granite extended wet and dry at temperatures to 800°C and pressures to 200 MPa.** Johnson, B.; Friedman, M.; Hopkins, T.W.; Bauer, S.J. (Dept. of Geology and Center for Tectonophysics, Texas A and M Univ., College Station). pp 399-412 of Rock mechanics: Proceedings of the 28th U.S. symposium. Farmer, I.W.; Daemen, J.J.K.; Desai, C.S.; Glass, C.E.; Neuman, S.P. Accord, MA; A.A. Balkema Publishers (1987). (CONF-870625—).

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

The strength of Westerly granite deformed in triaxial extension decreases significantly with increasing temperature with a disproportionately greater decrease occurring at the higher temperatures. The effects of temperature and water on strength are discussed. Microstructural analysis, microfracture statistics and microcrack patterns at failure are described. Data and results are given.

5804 Geochemistry

REFER ALSO TO CITATION(S) 12781, 12782

5805 Oceanography

REFER ALSO TO CITATION(S) 12422, 12423

12781 **(DOE/ER/60435—T3) Trace element geochemistry of the South Atlantic Bight: Progress report.** Windom, H.L. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). Dec 1987. Contract FG09-86ER60435. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003515/JAW.

Our major field effort involved participation in FLEX. Approximately 350 samples were collected for trace metal analyses. All of the SPREX data has been reduced and interpreted. One proposed paper describes a model for the flux of particulate material across the continental shelf. This model was applied to the particulate aluminum data collected during SPREX and will be used to estimate cross-shelf fluxes of particulate trace metals. The model will also serve as a basis for developing further models for freshwater, PON and POC fluxes during SPREX and FLEX. Another manuscript describes the estuarine behavior of plutonium and lead 210. A third manuscript describes trace metal behavior in the Savannah River estuary. All analyses and data reduction for Phase 1 and 2 sediment sampling campaigns have been completed. One paper, submitted for publication, shows that the major metal bearing phase in these sediments is aluminosilicate minerals. We will be interpreting these results during the coming year to estimate nearshore sediment removal of trace metals and nutrients and their cycling. Analyses of all pre-FLEX suspended sediment samples have been completed and will be used, with SPREX and FLEX data, to elucidate temporal variability on the composition of nearshore particles. Phase 3 sediments that were collected during our pre-FLEX Blue Fin cruise have been partially completed. 1 fig.

12782 **(DOE/ER/60450—T1) Coordination: Southeast continental shelf studies: Progress report, 1 June 1986-31 December 1987.** Menzel, D.W. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 11 Dec 1987. Contract FG09-86ER60450. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003680/JAW.

The principal investigator coordinated activities associated with the conduct of research on the oceanography of the southeastern continental shelf. These activities included serving as a contact between program managers at DOE and principal investigators associated with the program, developing long-range research plans, providing DOE with summaries of the results of past and current research activities, conducting planning/reporting meetings involving principal investigators and interested agency personnel, and consolidating and scheduling the use of research vessels. 270 refs.

12783 **(DS—3/362) Field surveys of log debris lines in the Tuktoyaktuk vicinity: implications to storm surge evaluation. Part 2. Final report.** Harper, J.R. (Dobrocky Seatech Ltd., Sidney, British Columbia (Canada)). 11 Feb 1987. vp. Indian and Northern Affairs Canada, Communications Branch, Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C.

This report summarizes the results of the second year of a field survey of storm-surge elevations in the Tuktoyaktuk vicinity of the Beaufort Sea. The project was completed under contract for Fisheries and Oceans Canada, Institute of Ocean Science, and for Indian and Northern Affairs to establish flood hazard levels in the Tuktoyaktuk vicinity. This report is intended as a methodology and data report only. Twenty sites were surveyed to delineate the regional variations in maximum storm surge elevation. 3 figs., 3 tabs.

64 PHYSICS I

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 12907

12784 **(AD-A—185432/2/XAB) Appearance and disappearance of magnetic flux on the quiet sun. Final report, 1 October 1981-31 December 1986.** Zirin, H.; Martin, S.F. (California Inst. of Tech., Pasadena (USA). Solar Astronomy Group). Jul 1987. 19p. NTIS, PC A03/MF A01.

This project yielded the following significant new discoveries and findings about solar magnetic fields: The majority of magnetic flux on the sun is observed to disappear when magnetic fields of one polarity migrate into or develop in juxtaposition with fields of opposite polarity. The cancellation of magnetic fields can be interpreted as: (a) submergence (b) reconnection, or (c) dissipation (annihilation) of magnetic fields. Large-scale filaments are observed to form in the chromosphere immediately above the boundaries between areas of network magnetic field of opposite polarity where network cancellation occurs. Small-scale filaments develop in asso-

ciation with small-scale cancelling magnetic fields at the rate of hundreds per day. Magnetic fields associated with large-scale solar convection cells, known as intranetwork magnetic fields, can be detected everywhere on the visible disk of the sun by using the videomagnetograph to integrate successive, 1/15 sec. magnetic field images for intervals of 1 to 10 minutes. The intranetwork fields appear to be a few seconds of arc in diameter, and have field strengths of the order of a few gauss to tens of gauss. The intranetwork fields appear to originate at the centers of supergranules and flow to the boundaries of the cells in approximately radial patterns.

12785 **(EFI—929(80)-86) Model-independent requirements to the source of positrons in the galactic centre.** Aharonyan, F.A. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700968/JAW.

The main requirements, following from the observational data in a wide range of electromagnetic waves, to positron source in the galactic centre are formulated. The most probable mechanism providing an efficiency of positron production of 10% is the pair production at photon-photon collisions. This mechanism can be realized a) in a thermal e/sup +/e/sup -/ pair-dominated weak-relativistic plasma and b) at the development of a nonthermal electromagnetic cascade initiated by relativistic particles in the field of X-rays. Gamma-astronomical observations in the region of E/sub γ/ $\geq$ 10/sup 11/ eV can be crucial in the choice of the model. 22 refs.

12786 **(EFI—932(83)-86) On the origin of ultrahigh-energy γ rays from Cyg X-3.** Aharonyan, F.A. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700970/JAW.

The gamma-ray production mechanisms in Cyg X-3 are discussed. It is shown that the observed features of gamma-ray spectra can be satisfactorily explained by a model in the framework of which gamma-rays are produced due to photomeson processes at interactions of accelerated protons with ambient low-frequency radiation. 12 refs.

12787 (INIS-mf—11089, pp 49) **Dynamo theories of solar flares.** Khan, J.I. (Sydney Univ., Australia. School of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

12788 **(ITEP—57(1987)) Hydrodynamical models of supernova SN 1987 A in the LMC.** Grassberg, E.K.; Imahennik, V.S.; Nadezhin, D.K.; Utrobin, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701123/JAW.

It is shown that the properties of SN 1987A in LMC can be described well by hydrodynamical models of explosions of compact massive stars. In accordance with these models, the mass of the expelled envelope the presupernova radius and the total energy of explosion are evaluated for SN 1987A to be $\sim$ 16M/sub Sun/, $\sim$ 30R/sub Sun/, and $\sim$ 3.10/sup 51/ erg, respectively. The progenitor of supernova remnant Cas A may be considered as the prototype to the SN 1987A in our own Galaxy. In other galaxies, this subtype of supernovae can be represented by SN 1948B in NGC6946. If energy of explosion transfers from collapsed core of the star to the envelope within timescale less than 1 hour, then delay $\Delta t \sim$ 3 hours between the neutrino pulse and the steep rise of optical luminosity of SN 1987A does not contradict with scenario of explosions of compact massive stars. 32 refs.; 3 figs.

12789 **(ITEP—190(1986)) Stage of spontaneous flame propagation in supernovae.** Blinnikov, S.I.; Khokhlov, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki; AN SSSR, Moscow. Astronomicheskij Sovet). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701382/JAW.

The stage of spontaneous flame propagation is considered at carbon ignition in the degenerate stellar core. An estimate of the critical temperature at runaway is obtained. For isocentropic temperature profile the velocity of the spontaneous combustion front is derived. The structure and evolution of the spontaneous front is considered analytically and numerically. The results of the previous estimates are confirmed. In particular at the final stages of spontaneous flame propagation the pressure and the velocity of matter behind the front reach the Chapman-Jouguet values and thus become substantially higher those for simultaneous burning. 15 refs.; 6 figs.; 2 tabs.

12790 **(LA-UR—87-3817) Oscillations of solar models with internal element diffusion.** Cox, A.N.; Guzik, J.A.; Kidman, R.B. (Los Alamos National Lab., NM (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). 1987. Contract W-7405-ENG-36. 6p. (CONF-8711112—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003156/JAW.

From Solar radiative output variations; Boulder, CO, USA (9 Nov 1987).

Two precision solar models have been constructed with the Iben evolution program, one with no diffusion of the internal atomic nuclei, and another that includes the effects of gravitational settling, thermal diffusion, and concentration gradient diffusion on the element abundances. This paper reports the results of these models. 8 figs., 3 tabs.

12791 **(LA-UR—87-4199) Gamma-ray and neutron spectroscopy of planetary surfaces and atmospheres.** Reedy, R.C. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 9p. (CONF-871245—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88004287/JAW.

From Workshop on nuclear spectroscopy of astrophysical sources; Washington, DC, USA (14 Dec 1987).

The neutrons and gamma rays escaping from a planet can be used to map the concentrations of various elements in its surface. In a planet, the high-energy particles in the galactic cosmic rays induce a cascade of particles that includes many neutrons. The γ rays are made by the decay of the naturally-occurring radioelements and by nuclear excitations induced by cosmic-ray particles and their secondaries (especially neutron capture or inelastic scattering reactions). After a short history of planetary γ-ray and neutron spectroscopy, the γ-ray spectrometer and active neutron detection system planned for the Mars Observer Mission are presented. The results of laboratory experiments that simulate the cosmic-ray bombardments of planetary surfaces and the status of the theoretical calculations for the processes that make and transport neutrons and γ rays will be reviewed. Studies of Mars, including its atmosphere, are emphasized, as are new ideas, concepts, and problems that have arisen over the last decade, such as Doppler broadening and peaks from neutron scattering with germanium nuclei in a γ-ray spectrometer. 23 refs., 1 fig.

12792 **(N—88-10611) Optical spectroscopy of IRAS sources with infrared emission bands. 1: IRAS 21282+5050 and the diffuse interstellar bands. Semiannual status report, 31 May-30 November 1987.** Cohen, M.; Jones, B.F. (California Univ., Berkeley (USA)). 1987. 25p. (NASA-CR—181387; NAS—1.26:181387). NTIS, PC A03/MF A01.

Spectroscopy of the starlike optical counterpart to IRAS 21282+5050, a source with the hydrocarbon infrared emission band spectrum, shows an 07(f)-(WC11) planetary nebula nucleus suffering an extinction of 5.7 mag. Emission line widths in the WC spectrum are only approx. 100 km/s, indicating a very slow stellar wind. Optical diffuse interstellar bands (DIBs) are prominent. Five

DIBs are strongly enhanced, namely lamda lamda 5797, 6196, 6203, 6283, and 6613. The presence of circumstellar hydrocarbon molecules may explain both the infrared emission bands and the enhanced DIBs.

12793 (N—88-10709, pp vp) **Overview of STIP intervals 15-19.** Shea, M.A.; Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Five STIP Intervals for special scientific study of solar and interplanetary phenomena were designated between February 1984 and March 1986. The first two intervals were selected retrospectively after unusual periods of solar activity; the remaining three intervals were selected in advance in conjunction with anticipated spacecraft configurations and measurements. In this overview the historical background of these STIP Intervals and a summary of the rationale in the selection of these particular time periods for concentrated studies are presented.

12794 (N—88-10709, pp vp) **Solar-terrestrial observations during STIP interval 15 (12-21 February 1984).** Kane, S.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

STIP interval XV covered the time period 12-21 February, 1984. Several large solar flares occurred during this period, the most significant being that on 16 February (0900 UT). Although this flare occurred about 40 deg behind the west limb of the Sun, both the occulted and the unocculted hard x-ray emission was obseved by instruments aboard spacecraft. The occulted radio emission and terrestrial effects were observed by several ground-based observatories. The flare produced energetic particles with energies up to several GeV. In spite of the location of the flare far behind the west limb, the high-energy particles produced a prompt and rapid increase in the ground-level neutron monitor rates. Observations of the solar-terrestrial effects of this and other flares during STIP interval XV are summarized and some of the implications of these new observations with respect to the acceleration and propagation of energetic solar particles and the role of flare-generated shocks will be discussed.

12795 (N—88-10709, pp vp) **Overview of the MONSEE UAG report on STIP intervals No. 15 and 16: The 24-25 April 1984 Forbush decrease period.** Coffey, H.E.; Allen, J.H. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The solar-terrestrial activity of 24-25 April 1894 is reviewed based on the MONSEE UAG-96 Report Solar-Geophysical Activity Reports for STIP Interval XVI 12-21 February 1984 Ground Level Event and STIP Interval XVI 20 April- 4 May 1984 Forbush Decrease (Helen E. Coffey and Joe H. Allen, compilers). A large 3B/X13.0 solar flare at 2356 UT on 24 April 1984 from the S11 E45 Solar Active Region (AR) 4474 produced major interplanetary and terrestrial environmental changes. The solar activity, the event itself, and the consequential, though temporary changes in the interplantary environment, in the near Earth space environment, and in the Earth's ionosphere and magnetic filed are discussed. For the Study of Travelling Interplanetary Phenomena (STIP) Symposium, emphasis will be placed on the solar, interplanetary, and cosmic ray observations.

12796 (N—88-10709, pp vp) **Low altitude flux and dose measurements during two solar flare events.** Brautigam, D.H.; Gussenhoven, M.S.; Mullen, E.G.; Oberhardt, M.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The dosimeter on board the low altitude polar orbiting DMSP/F7 satellite makes dose and flux measurements for electrons with energies greater than 1.0, 2.5, 5.0 and 10.0 MeV; and for protons with energies greater than 20, 35, 51, and 75 MeV. The characteristics and performance of the dosimeter are illustrated by presenting dose and flux data taken during the solar flare proton events of February 16 and April 26, 1984.

12797 (N—88-10709, pp vp) **Largest white light flare ever observed: 25 April 1984, 0001 UT.** Neidig, D.F.; Grosser, H.; Kiplinger, A.L. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The X13/3B flare of 25 April 1984, 0001 UT, was accompanied by intense white light emission that reached a peak power output approx 2x10 to the 29 erg/sec in the optical/near UV continuum; the total energy radiated in the continuum alone reached 10 to the 32 power ergs. This was the most powerful white light flare yet recorded, exceeding the peak output of the largest previously known event by more than one order of magnitude. The flare was a two-ribbon type with intense embedded kernels as observed in both Balmer-alpha line and Balmer continuum, and each of these flare ribbons covered separate umbrae shortly after the maximum of the event. The onset and peak of the white light emission coincided with the onset and peak of the associated E greater than 100 KeV hard x-ray burst, while the 1-8 angstrom soft x-ray emission reached its maximum 4 minutes after the peak in white light.

12798 (N—88-10709, pp vp) **Probable detection of solar neutrons by ground-level neutron monitors during STIP interval 16.** Shea, M.A.; Smart, D.F.; Flueckiger, E.O. (Bern Univ., Switzerland). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The third solar neutron event detected by Earth-orbiting spacecraft was observed during STIP Interval XVI. The solar flare beginning at 2356 UT on 24 April 1984 produced a variety of emissions including gamma rays and solar neutrons. The neutrons were observed by the SMM satellite and the neutron-decay protons were observed on the ISEE-3 spacecraft. Between 0000 and 0010 UT on 25 April an increase of 0.7 and 1.7 percent was recorded by neutron monitors at Tokyo (Itabashi) and Morioka, Japan. These stations were located about 42 degrees from the sub-solar point, and consequently, there is approximately 1400 grams of atmosphere between the incident neutrons at the top of the atmosphere and their detection on the Earth's surface. Nevertheless, the time coincidence of a small increase in the total counting rate of two independent neutron monitors indicates the presence of solar neutrons with energies greater than 400 MeV at the top of the Earth's atmosphere. The small increases in the counting rate emphasize the difficulty in identifying similar events using historical neutron monitor data.

12799 (N—88-10709, pp vp) **Solar energetic particles events observed by Prognoz-10 Intercosmos (May-October 1985).** Lutserko, V.; Fischer, S.; Vandas, M.; Kudela, K.; Stivka, M. (Kosice Technical Univ., Czechoslovakia). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

On 26 April 1985, Intershock began observation of a solar energetic particle (SEP) event, resulting from a 3B solar flare which originated on 24 April. The following observation period was quiet with only a few weak increases of low-energy protons of several days duration. Two prominent SEP events occurred on 9 July 1985 (start 0133 UT, position S13, W25) and 17 July (no opti-

cal data, type II radio burst from 0333 to 0348 UT). These mass ejection and particle propagation episodes were studied on the basis of x-ray, radio, and energetic particle emissions.

12800 (N—88-10709, pp vp) **Large Type 4 radio burst event of 24 April 1985 interpreted by dynamic spectral recordings and associated recordings.** Urbarz, H.W. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The Active Region 4647 showed a sudden increase in spot area on 23 April 1985 as well as an appearance of the D magneic configuration. During STIP interval XVII numerous subflares occurred in this region but only one very large event which exhibited all signatures of a classical p-event, well separated in time from other large events. The dynamic spectrum was observed at Bleien, Ondrejov, and Weissenau. The onset of radiation at m- and dm-waves is impulsive, and at dm-waves the preceeding dm continuum rises gradually. The absolute fluxes show very high readings of some 10 to the 4th power SFU at m-waves and some 5 x 10 to the 3d power at cm waves. High energy particles were observed about a day later by IMP 8. A Forbush decrease was seen on the neutron monitors but there was no GLE. The GOES x-ray flux monitors showed a gradual rise to high fluxes and a slow decrease over several hours. This information was extracted from Gdata but also from numerous letters from other observers and interpreters. More detailed data on the event and on the concomitant active region are to be presented.

12801 (N—88-10709, pp vp) **Propagating shocks in the corona.** Leblanc, Y. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

High resolution observations performed with the Decimeter spectrograph and the multichannel receiver at Nancay were analyzed in the range of 25-75 MHz. Sixty Type II bursts were selected. In this frequency range, type II events are generally associated with other radio emissions (such as storms of type III-U-I bursts); they are preceeded or followed by groups of U-bursts. One third of type II events show a nonuniform frequency drift, usually a steep decrease followed by an abrupt increase. This phenomenon can be explained by the propagation of an extended disturbance through the ambient corona when the density gradient is enhanced. An empirical coronal model is proposed to interpret these observations. The observations at fixed frequency of Type II bursts including fundamental and harmonic components are analyzed. It is shown that the spectrum of the intensity fluctuations differs with the fundamental and the harmonic components. The origin of these differences is discussed.

12802 (N—88-10709, pp vp) **Change in interplanetary shock acceleration preceding STIP Interval 17.** Gold, R.E.; Decker, R.B.; Lanzerotti, L.J.; Mclennan, C.G. (Bell Telephone Labs., Inc., Murray Hill, NJ). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The intensity and frequency of shock acceleration events in the interplanetary medium decreased dramatically in early 1985. Low energy ions were observed by IMP 8 at 1 AU and Voyagers 1 and 2 at 22 and 16 AU, respectively. Voyager 1 was at 25 deg heliographic latitude while IMP 8 and Voyager 2 were near the solar equatorial plane. The decrease in low energy shock events led to a drop in the average ion flux by a factor of 20 to 50. It started about day 10 of 1985 in the approximately .5 MeV channel on IMP8 and took approximately 75 days to reach the new, lower, background level. The decrease at the Voyagers started approximately 50 days later. The time delay between the start of the decrease at IMP and at Voyager 2 implies that decrease was convected outward with a velocity of approximately 535 km/sec. The intensity and frequency of interplanetary shock events remained at the lower level for at least 1.5 years.

12803 (N—88-10709, pp vp) **Solar modulation of the cosmic radiation in the heliosphere.** McKibben, R. B. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Changes in the solar modulation of galactic and anomalous component cosmic rays reflect changes in the structure and magnetic topology of the interplanetary medium. Therefore, to the extent that the modulation process is understood, the cosmic rays can be used as a probe of the medium to infer the extent and structure of the heliosphere in regions not directly sampled by spacecraft. The challenge to modulation theory and observation has been to determine which properties of the solar wind are most important for producing the observed modulation. Significant progress has been made in answering this question during the last solar cycle using observations from spacecraft at radii to 40 AU from the Sun and at latitudes up to 30 degrees with respect to the ecliptic. A brief summary of new results and observations (with specific attention to the STIP intervals XV-XIX) will be presented to illustrate the present state of our understanding of the relation between the solar wind and interplanetary magnetic field and the modulations of the cosmic radiation.

12804 (N—88-10709, pp vp) **Evolution of the solar wind structure in the outer heliosphere.** Whang, Y.C.; Burlaga, L.F. (Catholic Univ. of America, Washington, DC). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Shocks and interaction regions play very important roles in the evolution of large-scale solar wind structure in the outer heliosphere. This study is based on (1) plasma and magnetic field data observed from Voyager and Pioneer spacecraft, and (2) a quantitative magnetohydrodynamic simulation model. Interaction regions bounded by a forward and a reverse shock begin to form near 1 AU at the leading edges of a large-scale stream. The total pressure in the region is greater than the ambient pressure by a factor of ten or more. Large jumps in pressure remain as a prominant feature of the interplanetary structure even as the jumps in flow speed become less visible in the outer heliosphere. The propagation of the forward and reverse shocks widens the dimension of an interaction region. As a result, two interaction regions belonging to neighboring streams coalesce to form a merged interaction region (MIR). Collision and merging of shocks take place during the coalescence process. Two MIRs can themselves merge again at greater heliocentric distances. Simulation results agree well with spacecraft observations, and they explain major restructuring of the solar wind in the outer heliosphere.

12805 (N—88-10709, pp vp) **Comparison of MHD simulation for the February 1986 events with interplanetary observations by the spacecraft Sakigake.** Smith, Z.; Yeh, T.; Dryer, M.; Watanabe, T.; Oyama, K. (Tokyo Univ., Japan). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

During the period 3-10 February 1986 a series of major solar flares occurred and several intense geomagnetic storms took place on the Earth. To examine the causality between the solar activity and the geomagnetic activity in this period, a magnetohydrodynamic (MHD) numerical simulation was performed using a 2 1/2 -D numerical code. In that period of February 1986, the Japanese spacecraft Sakigake was at 0.84 AU, 57 deg west of the Earth. Besides the in-situ measurements of the interplanetary plasma, Sakigake also provided Doppler scintillation observations. Comparisons between the results of the MHD simulation and the measurements made by the spacecraft Sakigake are presented.

12806 (N—88-10709, pp vp) **Two dimensional imaging observations of meter-decameter bursts associated with the February 1986 flare activity.** Gopalswamy, N.; Kundu, M.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

An analysis is presented of the two dimensional imaging observations of a flare observed on 3 Feb. 1986 using the Clark Lake Multifrequency Radioheliograph. The flare produced almost all types of meter-decimeter radio emission: enhanced storm radiation, type III/V bursts, II and IV and flare continuum. The flare continuum had early (FCE) and late (FC II) components and the type II occurred during the period between these two components. Comparing the source positions of type III/V and FCE it was found that these bursts must have occurred along adjacent open and closed field lines, respectively. The positional analysis of type II and FC II implies that the nonthermal electrons responsible for FC II need not be accelerated by type II shock and this conclusion is further supported by the close association of FC II with a microwave peak. Using the positional and temporal analysis of all these bursts and the associated hard x-ray and microwave emissions, a schematic model is developed for the magnetic field configuration in the flaring region in which the nonthermal particles responsible for these bursts are confined or along which they propagate.

12807 (N—88-10709, pp vp) **Magnetic field twist driven by remote convective motions: Characteristics and twist rates.** Wang, Z.Z.; Hassam, A.B. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

It is generally believed that convective motions below the solar photosphere induce a twist in the coronal magnetic field as a result of frozen-in physics. A question of interest is how much twist can one expect from a persistent convective motion, given the fact that dissipative effects will eventually figure. This question is examined by considering a model problem: two conducting plates, with finite resistivity, are set in sheared motion and forced at constant relative speed. A resistive plasma is between the plates and an initially vertical magnetic field connects the plates. The time rate of tilt experienced by the field is obtained as a function of Hartmann number and the resistivity ratio. Both analytical and numerical approaches are considered.

12808 (N—88-10709, pp vp) **Study of pickup of cometary ions in turbulent solar winds.** Wu, C.S.; Price, C.P. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The influence of moderately strong magnetic disturbances on the ion pickup process near a comet is studied by a test-particle method. The research is motivated by recent observations with ICE and Giotto at Giacobini-Zinner and Halley. In this numerical study, the intrinsic hydromagnetic turbulence is modelled based on the Giotto and ICE data. The time evolution of the distribution function of the newborn ions is investigated. It is found that, when the level of the intrinsic turbulence is sufficiently high, the pickup ions can form a shell distribution function rapidly. The typical time scale for such a process is of the order of a couple of ion gyroperiods. On the other hand, if the turbulence is not strong, the pickup ions usually form an incomplete shell in the initial stage. The results seem to be consistent with available observations.

12809 (N—88-10709, pp vp) **Solar origins of coronal mass ejections.** Kahler, S. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The large scale properties of coronal mass ejections (CMEs), such as morphology, leading edge speed, and angular width and position, have been cataloged for many events observed with coronagraphs on the Skylab, P-78, and SMM spacecraft. While considerable study has been devoted to the characteristics of the SMEs, their solar origins are still only poorly understood. Recent observational work has involved statistical associations of CMEs with flares and filament eruptions, and some evidence exists that the flare and eruptive-filament associated CMEs define two classes of events, with the former being generally more energetic. Nevertheless, it is found that eruptive-filament CMEs can at times be very energetic, giving rise to interplanetary shocks and energetic particle events. The size of the impulsive phase in a flare-associated CME seems to play no significant role in the size or speed of the CME, but the angular sizes of CMEs may correlate with the scale sizes of the 1-8 angstrom x-ray flares. At the present time, He 10830 angstrom observations should be useful in studying the late development of double-ribbon flares and transient coronal holes to yield insights into the CME aftermath. The recently available white-light synoptic maps may also prove fruitful in defining the coronal conditions giving rise to CMEs.

12810 (N—88-10709, pp vp) **Association of erupting magnetic fields with eruptive prominences and coronal mass ejections.** Rompolt, B. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

A number of space and ground-based observations give evidence that the eruptive prominences, coronal mass ejections (CMEs) and associated shocks are generated by a common cause, i.e., the eruption of the magnetic field on the Sun. Some 60% of the observed CMEs are associated with the eruptive prominences. It is believed that in reality a much better correlation should be between these events because of observational limitations and of the effect of partial eruption. Some recent results on the formation and evolution of the quiescent and the active region prominences give an idea on the early phase of eruption of the magnetic field with the prominence plasma frozen in. In the latter phase of eruption the magnetic field lifted high into the corona and is seen (as manifested by the cold plasma frozen in) as a system of huge loops - evidently the result of some reconnections at lower heights. The legs of these erupting loops interact sometimes with the local magnetic field, i.e., it often appears to be an active region. In consequence of this interaction the activation of prominences and generation of flares can take place on some occasions as well as ejection of surges and sprays.

12811 (N—88-10709, pp vp) **Radio studies of large scale structures of the Sun's corona and transient activity.** Kundu, M.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The use of meter-decimeter wavelength imaging observations for four different kinds of studies of solar coronal activity is discussed. (1) Large scale structure of the upper corona; daily imaging observations permit comparison of radio images with white light images from space and ground observation, generation of synoptic charts similar to white light coronagraph synoptic charts, and comparison of radio brightness enhancements and deficiencies with bright coronal streamers and coronal holes. (2) Relative positions of type III burst sources and coronal streamers as observed by Solwind experiment on the P-78-1 satellite and by the HAO C/P experiment aboard the SMM; infer the paths of type III emitting electrons in dense coronal streamers, and from multifrequency observations derive electron density distributions above active regions near the limb. (3) Non-flare associated type II/type IV bursts associated with coronal streamer disruption events; such type IV sources have a rather slow velocity (approx = to or less than 100 km/s) CMEs. (4) Meter-decimeter microbursts; these are short duration (2-10 sec) weak-type III-like bursts, produced at the fundamental plasma frequency by plasma radiation processes which have important differ-

ences from the standard mechanisms used to explain the strong type III bursts.

12812 (N—88-10709, pp vp) **Observations of the brightness temperature distribution of the quiet solar corona at decametric wavelengths.** Sastry, CH.V. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The brightness temperature distribution of the quiet solar corona at a wavelength of 8.9 meters is measured by two types of radio telescope: (1) a 'T' type array with a resolution of 26'X38', and (2) a fan beam interferometer with an E-W resolution of 3'. It is found that the persistent bright regions do not have any angular structure on scales of 6' or less. The daily variations of the brightness temperature of different regions are studied and the possible interpretation discussed.

12813 (N—88-10709, pp vp) **Meterwave observations of a coronal hole.** Wang, Z.; Schmahl, E.J.; Kundu, M.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Meter-wave maps are presented showing a coronal hole at 30.9, 50.0, and 73.8 MHz using the Clark Lake Radioheliograph in October 1984. The coronal hole seen against the disk at all three frequencies shows interesting similarities to, and significant differences from its optical signatures in HeI lambda10830 spectroheliograms. The 73.8 MHz coronal hole, when seen near disk center, appears to coincide with the HeI footprint of the hole. At the lower frequencies, the emission comes from higher levels of the corona, and the hole appears to be displaced, probably due to the nonradial structure of the coronal hole. The contrast of the hole relative to the quiet Sun is much greater than reported previously for a coronal hole observed at 80 MHz. The higher contrast is certainly real, due to the superior dynamic range, sensitivity, and calibration of the Clark Lake instrument. Using a coronal hole model, the electron density is derived from radio observations of the brightness temperature. A very large discrepancy is found between the derived density and that determined from Skylab EUV observations of coronal holes. This discrepancy suggests that much of the physics of coronal holes has yet to be elucidated.

12814 (N—88-10709, pp vp) **Coronal and interplanetary Type 2 radio emission.** Cane, H.V. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Several observations suggest that the disturbances which generate coronal (meter wavelength) type II radio bursts are not driven by coronal mass ejections (CMEs). A new analysis using a large sample of metric radio bursts and associated soft x-ray events provides further support for the original hypothesis that type II-producing disturbances are blast waves generated at the time of impulsive energy release in flares. Interplanetary (IP) shocks, however, are closely associated with CMEs. The shocks responsible for IP type II events (observed at kilometer wavelengths) are associated with the most energetic CMEs.

12815 (N—88-10709, pp vp) **Coronal mass ejections: the long-term variation of their occurrence rate and the solar wind mass flux.** Webb, D.F. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Solar Coronal Mass Ejections (CMEs) from the Sun are an important aspect of coronal physics, and a potentially important contributor to the solar wind mass flux. However, despite significant progress in studies of CMEs since their discovery in the early 70's, questions remain about their effects on the interplanetary medium. A study is done of the long-term variations of the occurrence rates of CMEs, of activity tracers related to CMEs, and of the solar wind particle flux. CMEs are most directly detected by scattered electron radiation in white light. To estimate their long-term occurrence frequency and their contributions to the in-ecliptic solar wind mass flux, observed CME rates must be corrected for instrumental duty cycles, detection efficiency out of the plane of the sky, mass detection thresholds, and geometrical considerations. These corrections are evaluated using data on solar CMEs from the spaceborne Skylab, SMM, and SOLWIND coronagraphs and on interplanetary plasma clouds from the HELIOS white light photometers. Variations in the CME rate and the contribution of CMEs to the solar wind mass flux are traced over nearly a complete solar activity cycle.

12816 (N—88-10709, pp vp) **Was the eclipse comet of 1893 a disconnected coronal transient?.** Cliver, E.W. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The comet-like feature obsereved in the solar corona by the Lick Observatory eclipse expedition to Chile in 1893 bears an interesting resemblance to the disconnection coronal transient reported by Illing and Hundhausen. Reports of possibly-related limb activity are reviewed to see whether a pre-discovery observation of a relatively rare type of coronal mass ejection was mis-interpreted. The goal of this study is to learn more about the morphology of mass ejections by examining observations that extend down to the low corona of a disconnection event.

12817 (N—88-10709, pp vp) **Solar events and their influence on the interplanetary medium.** Joselyn, J. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Aspects of a workshop on Solar events and their influence on the interplanetary medium, held in September 1986, are reviewed, the goal of which was to foster interactions among colleagues, leading to an improved understanding of the unified relationship between solar events and interplanetary disturbances. The workshop consisted of three working groups: (1) flares, eruptives, and other near-Sun activity; (2) coronal mass ejections; and (3) interplanetary events. Each group discussed topics distributed in advance. The flares-eruptives group members agreed that pre-event energy is stored in stressed/sheared magnetic fields, but could not agree that flares and other eruptive events (e.g., eruptive solar prominences) are aspects of the same physical phenomenon. In the coronal mass ejection group, general agreement was reached on the presence of prominences in CMEs, and that they have a significant three-dimensional structure. Some topics identified for further research were the aftermath of CMEs (streamer deflections, transient coronal holes, possible disconnections), identification of the leading edge of CMEs, and studies of the range and prevalence of CME mass sizes and energies.

12818 (N—88-10709, pp vp) **Solar activity, magnetic clouds, and geomagnetic storms.** Wilson, R.M. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Associational aspects of magnetic clouds and solar activity, and of magnetic clouds and geomagentic storms are described. For example, recent research has shown associations to exist between the launch of magnetic clouds directed Earthward from the Sun and, in particular, two forms of solar activity: flare-related, type II metric radio bursts and disappearing filaments (prominences). Furthermore, recent research has shown an association to exist between the onset of magnetic clouds on Earth and the initiation of geomagnetic storms. Based on these findings, STIP Intervals XV-

XIX are examined for possible occurrences of Earthward-directed magnetic clouds.

12819 (N—88-10709, pp vp) **Dynamics of magnetic clouds in interplanetary space.** Yeh, T. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Magnetic clouds observed in interplanetary space may be regarded as extraneous bodies immersed in the magnetized medium of the solar wind. The interface between a magnetic cloud and its surrounding medium separates the internal and external magnetic fields. Polarization currents are induced in the peripheral layer to make the ambient magnetic field tangential. The motion of a magnetic cloud through the interplanetary medium may be partitioned into a translational motion of the magnetic cloud as a whole and an expansive motion of the volume relative to the axis of the magnetic cloud. The translational motion is determined by two kinds of forces, i.e., the gravitational force exerted by the Sun, and the hydromagnetic buoyancy force exerted by the surrounding medium. On the other hand, the expansive motion is determined by the pressure gradient sustaining the gross difference between the internal and external pressures and by the self-induced magnetic force that results from the interaction among the internal currents. The force resulting from the internal and external currents is a part of the hydromagnetic buoyancy force, manifested by a thermal stress caused by the inhomogeneity of the ambient magnetic pressure.

12820 (N—88-10709, pp vp) **Expansion of magnetic clouds.** Suess, S.T. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Magnetic clouds are a carefully defined subclass of all interplanetary signatures of coronal mass ejections whose geometry is thought to be that of a cylinder embedded in a plane. It has been found that the total magnetic pressure inside the clouds is higher than the ion pressure outside, and that the clouds are expanding at 1 AU at about half the local Alfven speed. The geometry of the clouds is such that even though the magnetic pressure inside is larger than the total pressure outside, expansion will not occur because the pressure is balanced by magnetic tension - the pinch effect. The evidence for expansion of clouds at 1 AU is nevertheless quite strong so another reason for its existence must be found. It is demonstrated that the observations can be reproduced by taking into account the effects of geometrical distortion of the low plasma beta clouds as they move away from the Sun.

12821 (N—88-10709, pp vp) **Numerical study of transient, thermally-conductive solar wind.** Han, S.M.; Wu, S.T.; Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

A numerical analysis of transient solar wind starting at the solar surface and arriving at 1 AU is performed by an implicit numerical method. The model hydrodynamic equations include thermal conduction terms for both steady and unsteady simulations. Simulation results show significant influence of thermal conduction on both steady and time-dependent solar wind. Higher thermal conduction results in higher solar wind speed, higher temperature, but lower plasma density at 1 AU. Higher base temperature at the solar surface gives lower plasma speed, lower temperature, but higher density at 1 AU. Higher base density, on the other hand, gives lower velocity, lower temperature, but higher density at 1 AU.

12822 (N—88-10709, pp vp) **Two-fluid model for solar wind fluid with higher order moments.** Wang, J.; Wu, S.T.; Jing, X.; Xiong, D. (Alabama Univ., Huntsville). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

A spherically symmetric two-fluid model for the solar wind with higher-order moments is presented. In this model, continuity, momentum, temperature and heat flux equations for two components (electrons and protrons) in steady solar wind states are simultaneously solved by using a time-dependent method. This work is used to compare solutions of the steady-state solar wind with and without higher order moments, and to study the effects of thermal conduction. The coupling between electrons and protrons is also given special attention. The numerical solutions of the steady-state solar wind in both subsonic and supersonic regions between the Sun and 1 AU are obtained and graphically illustrated.

12823 (N—88-10709, pp vp) **Interaction of interplanetary shocks with nonuniform ambient solar wind.** Chao, J.K.; Sheu, J.H. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Three interplanetary shock wave events are selected from the plasma and magnetic field data of Helios 1 and 2, IMP-8, and Voyagers 1 and 2 for study of the interactions of a weak interplantary shock with a nonuniform ambient solar wind. These events occurred during the periods 22-26 November 1977, 1-7 January 1978, and 2-5 April 1979, respectively. It is found that the shock surfaces of these events are highly distorted. In addition, a portion of the shock surface may be degenerated into a disturbance which does not satisfy the Rankine-Hugoniot jump conditions.

12824 (N—88-10709, pp vp) **Overview of STIP interval 18: September 1985, the G-Z encounter.** Zwickl, R.D. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The primary period of interest during September 1985 is the few days surrounding the ICE encounter with comet Giacobini-Zinner(G-Z) which occurred at 1102 UT on 11 September. To place into perspective the actual in situ observations measured during the comet encounter it is necessary to understand the prevailing solar and interplanetary conditions. Starting two solar rotations prior to and extending through the rotation after the encounter the interplanetary stream structure was very uniform, similar to the 1973-4 long-lived structure. Prior to the arrival of the corotating high-speed stream at 5 UT on 11 September, ICE was already measuring the effects of G-Z on the surrounding interplanetary medium. An overview of available solar, interplanetary, and ICE data for the cometary interval is presented.

12825 (N—88-10709, pp vp) **Comparative plasma tails of Venus and comets.** Perezdetejada, H. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

A review of current models of solar wind flow in the plasma tails of weakly magnetized bodies is presented. Measurements conducted by the Mariner 5 spacecraft, the Veneras 9 and 10, and the PVO orbiters, in the Venus tail, and with the ICE spacecraft in the tail of Comet Giacobini-Zinner, reveal common plasma properties which suggest that similar physical processes are operative. Most notable is the observation of decreased flow velocities and enhanced plasma temperatures in the vicinity of their plasma tails. In Venus, the measured velocity and temperature fields are consistent with the effects of frictional forces between the mass-loaded ionosheath flow and the ionosphere along the (magnetic) polar regions

of the ionopause. It is argued that similar conditions exist at a cometary ionopause and that the distribution of magnetic fluxes in a cometary tail is controlled by the entry of plasma fluxes from the (magnetic) polar regions of the comet's ionospheric obstacle. This question is further addressed in connection with the two-step shape of the magnetic profile measured across the tail of the comet. It is suggested that the low intensity outer increases of the magnetic lobes are associated with the draping of the interplanetary magnetic field lines around the comet's ionospheric obstacle, and that the higher intensity increases seen in the inner regions of the magnetic lobes are due to an additional compression of magnetic fluxes produced by the entry of plasma particles into the tail.

12826 (N—88-10709, pp vp) **Overview of plasma observations during the Halley flybys.** Reinhard, R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

In-situ observations made by the various plasma experiments onboard Giotto, Vega 1 and 2, Suisei, Sakigake, and ICE during the Halley flybys are summarized and discussed, starting with the phenomena furthest away (pick-up ions, plasma waves) and ending with the phenomena closest to the nucleus (magnetic cavity).

12827 (N—88-10709, pp vp) **Status of the international Halley watch.** Newburn, R.L. Jr.; Rahe, J. (Erlangen-Nuremberg Univ., West Germany). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

More than 1000 professional astronomers worldwide actually observed Halley's comet from the ground. Preliminary logs from the observers indicate that 20-40 Gbytes of data were acquired in eight professional disciplines and as much as 5 Gbytes in the amateur network. The latter will be used to fill in gaps in the Archive and to provide a visual light curve. In addition roughly 400 Mbytes of data were taken on Comet Giacobini-Zinner. Data will be accepted for archiving until early 1989. The permanent archive will consist of a set of CD-ROMs and a set of books, publication of both to be completed by mid-1990. Data from the space missions will be included but only on the CDs. From every indication, the ground based effort and the space missions complimented each other beautifully, both directly in the solution of spacecraft navigation problems and indirectly in the solution of scientific problems. The major remaining concern is that scientists submit their data to the Archive before the 1989 deadline.

12828 (N—88-10709, pp vp) **Large-scale interaction of the solar wind with comets Halley and Giacobini-Zinner.** Brandt, J.C.; Niedner, M.B. Jr. (Colorado Univ., Boulder). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

In-situ measurements of comets Halley and Giacobini-Zinner have confirmed the accepted basic physics of comet/solar wind interaction. The solar wind magnetic field is captured by the comet through the mechanism of field-line loading by cometary ions and the field lines drape around the cometary ionosphere. With this basic model in hand, the large-scale structure of the plasma tail as revealed by submissions to the Large Scale Phenomena Network of the International Halley Watch is reviewed. The turn-on and turn-off of plasma activity seem consistent with theory. Some 16 obvious disconnection events (DEs) have been recorded. Preliminary results showed agreement with the sector-boundary model; a detailed analysis of all DEs will be required in order to make a definitive statement. A study of plasma activity around the time of the VEGA encounters provides strong support for the sector-boundary model and illustrates once again the power of simultaneous remote and in-situ measurements.

12829 (N—88-10709, pp vp) **Global interaction of comets with the solar wind.** Houpis, H.L.F. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The recent in-situ measurements of the plasma-neutral gas environment of comet Halley by the GIOTTO and VEGA spacecraft have confirmed the global theory of the comet-solar wind interaction. The ionopause, cometopause, and bow shock distances are the primary predictions of the model, although various momentum collisional cross-sections can also be estimated. With this greater confidence in the global model, the sharp Sunward intensity decrease in the spatial H_3O+ profiles observed for comet Halley between 2.14 AU pre- and post-perihelion are interpreted as the cometopause boundary. This interpretation may then be used to determine the solar wind conditions local to the comet.

12830 (N—88-10709, pp vp) **Solar-terrestrial research in the space station era.** Chappell, C.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Because of the immense size of the solar-terrestrial system and its tightly-coupled physical nature, its study requires a carefully planned and coordinated approach using a variety of observational techniques. Of fundamental importance is the simultaneous measurement of the varying Sun, the solar wind, and the Earth's magnetosphere and atmosphere. These multiple measurements require a multi-spacecraft approach with both remote sensing of the Sun and atmosphere and in-situ measurements of the solar wind and magnetosphere. The decade of the 1990s will bring an opportunity to carry out the simultaneous set of measurements using a combination of instruments on missions such as the International Solar Terrestrial Physics Program, the GOES satellites, and the Space Station. For the first time it will be possible to determine solar variability and to sample the response of the solar wind and geospace portion of the environment in a thorough way. The potential opportunities for solar-terrestrial studies during the coming era of the Space Station are disclosed.

12831 (N—88-10709, pp vp) **Solar wind-cometary interaction at the ionopause and associated phenomena.** Ershkovich, A. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Solar wind-cometary interaction at the cometary ionopause (including the tail) is reviewed in the context of recent missions to comets Giacobini-Zinner and Halley. The role of various MHD instabilities is discussed. The apparent marginal instability of the ionopause of the comet Giacobini-Zinner and the stability of the comet Halley (for large wavelength perturbations) are explained essentially in terms of the different solar wind conditions encountered by the two comets. Nonlinear evolution of the instability is discussed. Waves of large amplitude arising due to the instability may intermix the plasma and result in heating and particle acceleration. A number of the observed phenomena found a natural explanation in terms of this mechanism.

12832 (N—88-10709, pp vp) **Comet West: a view from the HELIOS zodiacal light photometers.** Benensohn, R.M.; Jackson, B.V. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Comet West passed through perihelion on February 25, 1976. The comet crossed the HELIOS A and B spacecraft zodiacal light photometer fields of view as the spacecraft orbited the Sun, allowing them to record the brightness, polarization, and color of the comet and its surrounding interplanetary medium. Data from

the U, B, and V photometers across the tail shows a distinct bluing followed by a slight reddening corresponding to the ion and dust tails, respectively, entering the field of view. The non-Earth perspective of the HELIOS photometers allows a comparison of the tail with Earth observations at the same time. Precise location of the nucleus and tail allow the photometer data to be searched for evidence of the comet bow shock and orbital dust. A brightness bump present in the data before the comet reaches some photometer positions, can be shown to approximately form a parabolic shape Sunward and ahead of the orbital motion of the Comet West nucleus. If this is the comet bow shock or bow compression, then it corresponds to a density enhancement of the ambient medium by 1.5 to 2 times in the vicinity of the comet. The distance of the brightness increase from the nucleus by comparison with Comet Halley implies a neutral gas production rate of approximately 3 times that of Halley.

12833 (N—88-10709, pp vp) **Solar wind effects on the outer ion coma of Comet Halley.** Flammer, K.R. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

A simple two-dimensional model is developed to examine the composition of the cometary ion coma in the region outside the ionopause which is strongly affected by the solar wind. Two-dimensional ion distributions are obtained assuming a cylindrically symmetric ion coma which accounts for the dynamic effects of the mass-loaded solar wind flow around the cometary ionosphere. The results of this model are discussed in the context of analyzing the GIOTTO ion data.

12834 (N—88-10709, pp vp) **Solar wind interaction with comets: a post encounter view.** Mendis, D.A. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The recent spacecraft encounters with comets Giacobini-Zinner and Halley have led to an enormous increase in our knowledge of comets, including their dust, neutral gas, plasma, and magnetic field environments. The latter has in turn led to better understanding of the nature of the solar wind interaction with the well developed atmosphere of a comet. The post-encounter understanding of this interaction is reviewed, underscoring the differences with pre-encounter reasoning. The problems outstanding in this area are emphasized.

12835 (N—88-10709, pp vp) **Plasma-tail activity and the interplanetary medium at Halley's Comet during Armada Week: 6-14 March 1986.** Niedner, M.B. Jr.; Schwingenschuh, K.; Hoeksema, J.T.; Dryer, M.; Mcintosh, P.S. (National Oceanic and Atmospheric Administration, Boulder, CA). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The encounters of five spacecraft with Halley's Comet during 6-14 March 1986 offered a unique opportunity to calibrate the solar-wind interaction with cometary plasmas as recorded by remote wide-field and narrow-field/narrowband imaging. Perhaps not generally recognized in the comet community is the additional opportunity offered by the Halley Armada to study the structure of the solar-wind and interplanetary magnetic field (IMF) in three dimensions using five sets of data obtained over similar time intervals and heliocentric distances, but at somewhat different heliolatitudes. In fact, the two problems, i.e., comet physics and the structure of the interplanetary medium, are coupled if one wants to understand what conditions pertained at the comet between the encounters. This relationship is discussed.

12836 (N—88-10709, pp vp) **Occultation of compact radio sources by the ion tail of Halley's Comet.** Alurkar, S.K.; Bhonsle, R.V.; Sharma, A.K. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Enhancements of scintillations of the compact radio sources PKS 2314+03 and 1827-360 were observed at 103 MHz and 408 MHz during 18-21 December 1985 and on 29 March 1986, respectively, when the plasma tail of Halley's Comet swept across them. At 103 MHz the RMS plasma density variation along the tail was 10 and 3.3/cu cm at 0.12 AU and 0.18 AU, respectively, as measured from the comet's position. At 408 MHz it was 1.9/cu cm at 0.036 AU. Comparison of results of these two sets of observations is presented.

12837 (N—88-10709, pp 1) **Simulation of the IPS variations from a magnetohydrodynamical simulation.** Tappin, S.J.; Dryer, M.; Han, S.M.; Wu, S.T. (Alabama Univ., Huntsville). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Calculations of the variations of interplanetary scintillation (IPS) from a disturbance simulated by a 3-D magnetohydrodynamical (MHD) model of the solar wind are presented. The simulated maps are compared with observations and it is found that the MHD model reproduces the qualitative features of observed disturbances. The disturbance produced by the MHD simulation is found to correspond in strength with the weakest disturbance which can be reliably detected by existing single station IPS observations.

12838 (N—88-10709, pp vp) **Study of the mechanism for solar wind formation.** Eselevich, V.G.; Filippov, M.A. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

Observations of the corona and solar wind are analyzed and compared with generalized results derived from laboratory-scale experiments. It was shown that a thermal pressure gradient can make a major contribution to a precipitating plasma of the solar wind emanating from coronal holes. It is found that the divergence Phi = (R/R sub solar radius)f of the magnetic field lines, originating from coronal holes, is one of the factors governing solar wind velocity at Earth orbit (R= 1 AU). A decrease in the velocity V sub R = 1 AU from approx = 750 mk/sec down to approx = 450 km/sec may be attributable to an increase in superradial divergence f from approx = 7-9 to 20. The plasma energy flux density F at the base of the coronal holes representing the sources of the solar wind with V sub R=1AE = (450 to 750) km/sec, remains nearly constant, being F approx = (1.4 +/- 0.3) x 10 to the 6th power x erga/sq cm/sec for the period 1973-1975.

12839 (N—88-10709, pp vp) **Account of a flare related shock event recorded by the energetic particle detector EPONA of the Giotto spacecraft during September 1985 (STIP interval 18).** Mckennalawlor, S.M.P.; Kirsch, E.; Daly, P.; Osullivan, D.; Thompson, A.; Wenzel, P.K. (European Space Research and Technology Center, Noordwijk, Netherlands). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The Energetic Particle Detector EPONA flown on the Giotto Mission to Halley's Comet was designed to measure electrons, protons, and heavier ions (E greater that 20 keV) in the Comet Halley environment and during the Cruise Phase of the mission (EPONA switch on: 22 August 1985 - Halley encounter: 13 March 1986). In September 1985 (STIP Interval XVIII) a well de-

fined shock event was recorded at EPONA in association with a sequence of solar flares and a preliminary account of this event is presented.

12840 (N—88-10709, pp vp) **Interactions of oblique interplanetary discontinuities and their manifestations during STIP intervals 15-19.** Grib, S.A.; Pushkar, E.A. (Academy of Sciences, USSR, Moscow). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The generation of slow shock waves as the result of the interaction of Alfven discontinuities with solar wind contact surfaces is considered. The latter are taken to be the boundaries of proton and alpha-particle concentration inhomogeneities. It is found that the intensity of the Alfven discontinuity may be increased as the result of its interaction with the more dense plasma. The converse (i.e., decrease of the Alfven discontinuity's intensity following interaction with a less dense plasma) is also indicated. Also discussed is the generation of a magnetic cloud as the result of the interaction of a quasi-parallel Alfven discontinuity with a dense plasma contact surface. It is shown that the (solar-generated) Alfven discontinuity may then be transformed into non-flare fast and slow shock waves as the result of this interaction. Thus, it is indicated that some fast shock waves in the solar wind may have a nonsolar origin.

12841 (N—88-10709, pp vp) **Intershock observations during STIP intervals 17 and 18.** Zastenker, G.; Borodkova, N.; Yermolayev, YU.; Zhuraviev, V.; Lutsenko, V.; Klimov, S.; Fischer, S.; Vandas, M.; Kudela, K.; Slivka, M. (Kosice Technical Univ., Czechoslovakia). Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The Prognoz-10/Intercosmos satellite (Intershock Project) carried out observations from Earth orbit from 26 April 1985 until 11 November 1985, covering STIP Intervals XVII and XVIII. Data obtained during the systematic measurements in the course of STIP Interval XVII and part of XVIII are presented; i.e., hourly averages of the solar wind velocity, temperature and ion concentration, ion flux changes (10 to the -1 to 10 to the -3 Hz), plasma wave parameters, energetic particles flux, magnetic fields, etc. Special attention is paid to solar wind distrubances causing abrupt and large effects on the shape of the bow shock (i.e., on 2 May 1985 and 14 September 1985). Generally, the observation period was very close to a minimum of solar activity and was quiet without significant interplanetary shocks.

12842 **(N—88-10709) STIP symposium on physical interpretation of solar/interplanetary and cometary intervals. Final report, 1 April-30 September 1987. Abstracts only.** (Alabama Univ., Huntsville (USA)). Sep 1987. 73p. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—). NTIS, PC A04/MF A01.

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The study of travelling interplanetary phenomena has continued over a period of years. The STIP (Study of Travelling Interplanetary Phenomena) Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals was held in Huntsville, Alabama, on May 12-15, 1987, the first of these meetings to be held in the United States. The Symposium's objective was to coordinate and disseminate new science gained from the recent solar-terrestrial and cometary intervals which can be used to better understand the linkage of physical events to the Sun's vagaries (flares, coronal holes, eruptive prominences) from their initial detection to their consequence. Fifty-one presentations were made during the four-day period. Abstracts of these reports are included as Appendix A.

12843 **(N—88-10763) Research in particles and fields. Semiannual status report.** Stone, E.C.; Davis, L. Jr.; Mewaldt, R.A.; Prince, T.A. (California Inst. of Tech., Pasadena (USA)). Oct 1987. 38p. (NASA-CR—180412; NAS—1.26:180412). NTIS, PC A03/MF A01.

Discussed are the research activities in Cosmic Rays, Gamma Rays, and Astrophysical Plasmas supported under NASA Grant NGR 05-002-160. The report is divided into sections which describe the activities, followed by a bibliography. This research program is directed toward the investigation of the astrophysical aspects of cosmic rays and gamma rays and of the radiation and electromagnetic field environment of the Earth and other planets. These investigations are carried out by means of energetic particle and photon detector systems flown on spacecraft and balloons.

12844 **(N—88-10764) Program to study antiprotons in the cosmic rays: Arizona collaboration.** Bowen, T. (Arizona Univ., Tucson (USA)). Oct 1987. 13p. (NASA-CR—180702; NAS—1.26:180702). NTIS, PC A03/MF A01.

The Low Energy AntiProton (LEAP) experiment was designed to measure the primary antiproton flux in the 200 MeV to 1 GeV kinetic energy range. A superconducting magnetic spectrometer, a time-of-flight (TOF) detector, and a Cherenkov counter are the main components of LEAP. An additional scintillation detector was designed and constructed to detect the passage of particles through the bottom of the Cherenkov counter. The LEAP package was launched on August 22, 1987, and enjoyed a 27 hour flight, with 23 hours of data at high altitude. Preliminary plans for data analysis include using the Micro-Vax at the University of Arizona for data reduction of the Cherenkov and S2 signals.

12845 **(N—88-11579) Soft x-ray observations of pre-main sequence stars in the Chamaeleon dark cloud.** Feigelson, E.D.; Kriss, G.A. (Pennsylvania State Univ., University Park (USA). Davey Lab.). Sep 1987. 46p. (NASA-CR—181457; NAS—1.26:181457). NTIS, PC A03/MF A01.

Einstein IPC observations of the nearby Chamaeleon I star forming cloud show 22 well-resolved soft x-ray sources in a 1x2 deg region. Twelve are associated with H-alpha emission line pre-main sequence (PMS) stars, and four with optically selected PMS stars. Several x-ray sources have two or more PMS stars in their error circles. Optical spectra were obtained at CTIO of possible stellar counterparts of the remaining x-ray sources. They reveal 5 probable new cloud members, K7-MO stars with weak or absent emission lines. These naked x-ray selected PMS stars are similar to those found in the Taurus-Auriga cloud. The spatial distributions and H-R diagrams of the x-ray and optically selected PMS stars in the cloud are very similar. Luminosity functions indicate the Chamaeleon stars are on average approximately 5 times more x-ray luminous than Pleiad dwarfs. A significant correlation between L sub x and optical magnitude suggests this trend may continue within the PMS phase of stellar evolution. The relation of increasing x-ray luminosity with decreasing stellar ages is thus extended to stellar ages as young as 1 million years.

12846 **(N—88-11592) M-type stars.** (National Aeronautics and Space Administration, Washington, DC (USA)). 1987. 576p. (NASA-SP—492; NAS—1.21:492; LC—87-11340). SOD HC $26.00 as 033-000-01007-9; NTIS MF A01.

The papers in this volume cover the following topics: (1) basic properties and photometric variability of M and related stars; (2) spectroscopy and nonthermal processes; (3) circumstellar radio molecular lines; (4) circumstellar shells, the formation of grains, and radiation transfer; (5) mass loss; (6) circumstellar chemistry; (7) thermal atmospheric models; (8) quasi-thermal models; (9) observations on the atmospheres of M dwarfs; and (1) theoretical work on M dwarfs.

12847 (N—88-11592, pp 112) **Basic properties and variability.** Querci, F.R. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Giant and supergiant M, S, and C stars are discussed in this survey of research. Basic properties as determined by spectra,

chemical composition, photometry, or variability type are discussed. Space motions and space distributions of cool giants are described. Distribution of these stars in our galaxy and those nearby is discussed. Mira variables in particular are surveyed with emphasis on the following topics: (1) phase lag phenomenon; (2) Mira light curves; (3) variations in color indices; (4) determination of multiple periods; (5) correlations between quantities such as period length, light-curve shape, infrared (IR) excess, and visible and IR color diagram; (6) semiregular (SR) variables and different time scales in SR light variations; (7) irregular variable Lb and Lc stars; (8) different time-scale light variations; (9) hydrogen-deficient carbon (HdC) stars, in particular RCB stars; and (10) irreversible changes and rapid evolution in red variable stars.

12848 (N—88-11592, pp 95) **Spectroscopy and nonthermal processes.** Querci, M. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Stellar spectra are analyzed to determine nonthermal processes for cool stars. A shock wave crossing model is supported by a study of the behavior of absorption and emission spectra. The shock waves are attributed to atmospheric kinetics. Circumstellar spectral lines are studied for information about gaseous circumstellar layers. The description of stellar envelopes is carried on through circumstellar dust. Characteristic properties of polarization in the dust are described in the case of specific stars, emphasizing narrowband observations in Mira, semiregular, and supergiant stars. Finally, the direct approach to measuring the angular diameters of stars and mapping the distribution of circumstellar dust and gas by lunar occultation or interferometry is discussed, using two prototype stars, an M supergiant and a dusty carbon star.

12849 (N—88-11592, pp 16) **Circumstellar radio molecular lines.** NGUYEN, Q.R. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Radio molecular lines appear to be useful probes into the stellar environment. Silicon oxide masers provide information on the physical conditions in the immediate vicinity of the stellar photosphere. Valuable information on the physics operating in the envelope of IRC + 10216 was recently obtained by high sensitivity observations and detailed theoretical analyses. Infrared speckle interferometry in the molecular lines and in the continuum is helpful in the investigation of the inner region of the envelope. These techniques are discussed in terms of late-type star mass loss.

12850 (N—88-11592, pp 20) **Circumstellar shells, the formation of grains, and radiation transfer.** Lefevre, J. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Advances in infrared astronomy during the last decade have firmly established the presence of dust around a large number of cold giant and supergiant stars. To describe the properties of stars and to understand their evolution, it is necessary to know the nature of the giants and their influence on stellar radiation. Two questions are considered: the formation of grains around cold stars and the modification of stellar radiation by the stellar shell.

12851 (N—88-11592, pp 45) **Mass loss.** Goldberg, L. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Observational evidence for mass loss from cool stars is reviewed. Spectra line profiles are used for the derivation of mass-loss rates with the aid of the equation of continuity. This equation implies steady mass loss with spherical symmetry. Data from binary stars, Mira variables, and red giants in globular clusters are examined. Silicate emission is discussed as a useful indicator of mass loss in the middle infrared spectra. The use of thermal millimeter-wave radiation, Very Large Array (VLA) measurement of radio emission, and OH/IR masers are discussed as a tool for mass loss measurement. Evidence for nonsteady mass loss is also reviewed.

12852 (N—88-11592, pp 32) **Circumstellar chemistry.** Glassgold, A.E.; Huggins, P.J. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

The study of the outer envelopes of cool evolved stars has become an active area of research. The physical properties of CS envelopes are presented. Observations of many wavelengths bands are relevant. A summary of observations and a discussion of theoretical considerations concerning the chemistry are summarized. Recent theoretical considerations show that the thermal equilibrium model is of limited use for understanding the chemistry of the outer CS envelopes. The theoretical modeling of the chemistry of CS envelopes provides a quantitive test of chemical concepts which have a broader interest than the envelopes themselves.

12853 (N—88-11592, pp 49) **Thermal atmospheric models.** Johnson, H.R. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

The static thermal atmosphere is described and its predictions are compared to observations both to test the validity of the classic assumptions and to distinguish and describe those spectral features with diagnostic value.

12854 (N—88-11592, pp 36) **Quasi-thermal models.** Delareza, R. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Non-local thermodynamics equilibrium (LTE) effects in the photosphere; recent research on the chromosphere of the M and C stars; and elementary shock-waves and pulsation theories and their applications to Mira long-period variables are discussed.

12855 (N—88-11592, pp 45) **Atmospheres of M dwarfs: observations.** Rodono, M. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

After presenting global properties of M dwarfs, the principal diagnostic of activity phenomena occurring in their atmosphere from the geometrical, energetic, and temporal points of view is streased. Observations of sunspots, plages, flares, and activity cycles are presented. The major sources of activity are discussed with particular emphasis on the generation, intensification, and measurements of stellar magnetic fields.

12856 (N—88-11592, pp 25) **M dwarfs: theoretical work.** Mullan, D.J. 1987. SOD HC $26.00 as 033-000-01007-9; NTIS MF A01. (NASA-SP—492; NAS—1.21:492; LC—87-11340).

In M-type stars.

Theoretical work on the atmospheres of M dwarfs has progressed along lines parallel to those followed in the study of other classes of stars. Such models have become increasingly sophisticated as improvements in opacities, in the equation of state, and in the treatment of convection were incorporated during the last 15 to 20 years. As a result, spectrophotometric data on M dwarfs can now be fitted rather well by current models. The various attempts at modeling M dwarf photospheres in purely thermal terms are summarized. Some extensions of these models to include the effects of microturbulence and magnetic inhomogeneities are presented.

12857 (N—88-11603) **Composition, structure and chemistry of interstellar dust.** Tielens, A.G.G.M.; Allamandola, L.J. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Sep 1986. 76p. (NASA-TM—88350; A—86383; NAS—1.15:88350). NTIS, PC A05/MF A01.

The observational constraints on the composition of the interstellar dust are analyzed. The dust in the diffuse interstellar medium consists of a mixture of stardust (amorphous silicates, amorphous carbon, polycyclic aromatic hydrocarbons, and graphite) and interstellar medium dust (organic refractory material). Star-

dust seems to dominate in the local diffuse interstellar medium. Inside molecular clouds, however, icy grain mantles are also important. The structural differences between crystalline and amorphous materials, which lead to differences in the optical properties, are discussed. The astrophysical consequences are briefly examined. The physical principles of grain surface chemistry are discussed and applied to the formation of molecular hydrogen and icy grain mantles inside dense molecular clouds. Transformation of these icy grain mantles into the organic refractory dust component observed in the diffuse interstellar medium requires ultraviolet sources inside molecular clouds as well as radical diffusion promoted by transient heating of the mantle. The latter process also returns a considerable fraction of the molecules in the grain mantle to the gas phase.

12858 (N—88-11606) **Laboratory evaluation and application of microwave absorption properties under simulated conditions for planetary atmospheres. Annual status report and Semiannual status report No. 8, 1 February 1987-31 January 1988.** Steffes, P.G. (Georgia Inst. of Tech., Atlanta (USA)). Nov 1987. 51p. (NASA-CR—181466; NAS—1.26:181466). NTIS, PC A04/MF A01.

Radio absorptivity data for planetary atmospheres obtained from spacecraft radio occultation experiments and Earth-based radio astronomical observations can be used to infer abundances of microwave absorbing atmospheric constituents in those atmospheres, as long as reliable information regarding the microwave absorping properties of potential constituents is available. The use of theoretically derived microwave absorption properties for such atmospheric constituents, or laboratory measurements of such properties under environmental conditions which are significantly different than those of the planetary atmosphere being studied, often leads to significant misinterpretation of available opacity data. Laboratory measurement of the microwave properties of atmospheric gases under simulated conditions for the outer planets were conducted. Results of these measurements are discussed.

12859 (N—88-11609) **Theoretical Problems in High Resolution Solar Physics, 2.** Athay, G.; Spicer, D.S. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Sep 1987. 141p. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—). NTIS, PC A07/MF A01.

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

The Science Working Group for the High Resolution Solar Observatory (HRSO) laid plans beginning in 1984 for a series of workshops designed to stimulate a broadbased input from the scientific community to the HRSO mission. These workshops have the dual objectives of encouraging an early start on the difficult theoretical problems in radiative transfer, magnetohydrodynamics, and plasma physics that will be posed by the HRSO data, and maintaining current discussions of results in high resolution solar studies. This workshop was the second in the series. The workshop format presented invited review papers during the formal sessions and contributed poster papers for discussions during open periods. Both are presented.

12860 (N—88-11609, pp vp) **Magnetic field morphology in the upper layers.** Pizzo, V.J. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

Some basic properties of emerged magnetic flux concentrations are examined with emphasis on the interplay between the magnetic and thermodynamic structure in the region between the photosphere and the transition zone. The discussion is limited to the gross behavior of those phenomena that may be reasonably regarded as quasi-static, such as the longer-lived sunspots, pores, and some smaller magnetic flux tubes. Substructure and dynamic phenomena are not considered.

12861 (N—88-11609, pp vp) **Active region flows.** Foukal, P. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

A wide range of observations has shown that active region phenomena in the photospheric, chromospheric and coronal temperature regimes are dynamical in nature. At the photosphere, recent observations of full line profiles place an upper limit of about + or - 20/msec on any downflows at supergranule cell edges. Observations of the full Stokes 5 profiles in the network show no evidence for downflows in magnetic flux tubes. In the area of chromospheric dynamics, several models were put forward recently to reproduce the observed behavior of spicules. However, it is pointed out that these adiabatic models do not include the powerful radiative dissipation which tend to damp out the large amplitude disturbances that produce the spicular acceleration in the models. In the corona, loop flows along field lines clearly transport mass and energy at rates important for the dynamics of these structures. However, advances in understanding the heating and mass balance of the loop structures seem to require new kinds of observations. Some results are presented using a remote sensing diagnostic of the intensity and orientation of macroscopic plasma electric fields predicted by models of reconnective heating and also wave heating.

12862 (N—88-11609, pp vp) **What's needed in the UV and EUV.** Doschek, G.A. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

High spectral and spatial resolution UV and EUV spectroscopy is discussed with emphasis on the spectroscopic observations that are required in order to increase the understanding of the physics of the lower transition region. The properties of the lower transition region are reviewed, and the available lower transition region plasma diagnostics are reviewed for the wavelength range between about 1150 and 2000 A. One important conclusion is that comprehensive spectroscopic coverage over a rather broad temperature range is necessary in order to observe satisfactorily small transition region structures. This is illustrated by two examples from the recent NRL Spacelab 2 HRTS experiment.

12863 (N—88-11609, pp vp) **First results on quiet and magnetic granulation from SOUP.** Title, A.M.; Tarbell, T.D.; Acton, L.; Duncan, D.; Ferguson, S.H.; Finch, M.; Frank, Z.; Kelly, G.; Lindgren, R.; Morrill, M. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

The flight of Solar Optical Universal Polarimeter (SOUP) on Spacelab 2 allowed the collection of time sequences of diffraction limited (0.5 arc sec) granulation images with excellent pointing (0.003 arc sec) and completely free of the distortion that plagues groundbased images. The p-mode oscillations are clearly seen in the data. Using Fourier transforms in the temporal and spatial domain, it was shown that the p-modes dominate the autocorrelation lifetime in magnetic regions. When these oscillations are removed the autocorrelation lifetime is found to be 500 sec in quiet and 950 sec in magnetic regions. In quiet areas exploding granules are seen to be common. It is speculated that a significant fraction of granule lifetimes are terminated by nearby explosions. Using local correlation tracking techniques it was able to measure horizontal displacements, and thus transverse velocities, in the magnetic field. In quiet sun it is possible to detect both super and mesogranulation. Horizontal velocities are as great as 1000 m/s and the average velocity is 400 m/s. In magnetic regions horizontal velocities are much less, about 100 m/s.

12864 (N—88-11609, pp vp) **High-resolution continuum observations of the Sun.** Zirin, H. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

The aim of the PFI or photometric filtergraph instrument is to observe the Sun in the continuum with as high resolution as possible and utilizing the widest range of wavelengths. Because of financial and political problems the CCD was eliminated so that the highest photometric accuracy is only obtainable by comparison

with the CFS images. Presently there is a limitation to wavelengths above 2200 A due to the lack of sensitivity of untreated film below 2200 A. Therefore the experiment at present consists of a film camera with 1000 feet of film and 12 filters. The PFI experiments are outlined using only two cameras. Some further problems of the experiment are addressed.

12865 (N—88-11609, pp vp) **Small-scale energy storage and release as the cause of the stellar X-ray corona.** Parker, E.N. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

It has yet to be established why ordinary stars possess x-ray coronas. Detailed observations of the Sun make it doubtful that the x-ray corona is produced by the dissipation of Alfven waves. The uniform x-ray brightness over all scales from 10,000 to 100,000 km simply does not look like a resonance phenomenon. It is demonstrated that the arbitrary winding patterns introduced into the bipolar magnetic fields of x-ray corona produce discontinuities within the field. It is suggested that the random motions of the footprints of the field cause the accumulation of internal strains in the field, which dissipate through neutral reconnection across the associated discontinuities to provide the primary heat source for the x-ray corona. It is emphasized, however, that the essential high resolution observations of the Sun have yet to be carried out, and until the theory is firmly established for the Sun, it cannot be known how to interpret the x-ray emission of the Sun or of the other stars.

12866 (N—88-11609, pp vp) **Magnetic fields in the overshoot zone: the great escape.** Cattaneo, F.; Hughes, D.W. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

In order that magnetic flux be confined within the solar interior for times comparable to the solar cycle period it has been suggested that the bulk of the solar toroidal field is stored in the convectively stable overshoot region situated beneath the convection zone proper. Such a magnetic field, though, is still buoyant and is therefore subject to Rayleigh-Taylor type instabilities. The model problem of an isolated region of magnetic field embedded in a convectively stable atmosphere is considered. The fully nonlinear evolution of the two dimensional interchange of modes is studied, thereby shedding some light on one of the processes responsible for the escape of flux from the solar interior.

12867 (N—88-11609, pp vp) **Theoretical modelling of the fine structures in sunspots.** Choudhuri, A.R. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

Until a decade ago most solar physicists thought of a sunspot as the upper end of a giant flux tube floating vertically. The existence of umbral dots and penumbral grains has been known for several decades. On the basis of available observations, they seem to be regions of photospheric intensity with upflowing gas motion and magnetic fields much weaker than in the surrounding sunspot surface. It has also been suggested that the differences in the appearances of umbral dots and granular cells are caused by the highly nonlinear nature of the convection problem in the presense of strong magnetic fields. The main ideas are presented here without any equations. It can be shown that a pocket of field free gas surrounded by a vertical magnetic field in the presence of gravity takes up the shape of a tapering column ending at a vertex at the top. Some convection is expected to take place in the trapped field free gas, whereas the magnetic field around it makes those regions stable against convection. Eventually the apex of the tapering column reaches the photospheric surface where the bulging of the magnetic field makes the field no longer able to close on the field free gas and trap it underneath.

12868 (N—88-11609, pp vp) **Pressure structure of solar coronal loops.** Krishan, V. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

The steady state pressure structure of a coronal loop is discussed in terms of the MHD global invariants of an incompressible plasma. The steady state is represented by the superposition of two Chandrasekhar-Kendall functions corresponding to (n=m=0) and (n=m=1) modes. The relative contribution of the two modes (epsilon) is found to depend on the surface pressure of the coronal loop which is also the pressure of the external medium. The mixed mode state does not exist for high values of the external pressure because epsilon becomes complex.

12869 (N—88-11609, pp vp) **Numerical study of the thermal stability of solar loops.** Klimchuk, J.A.; Antiochos, S.K.; Mariska, J.T. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

An important property of all loops is their thermal stability. If low lying hot loops were thermally unstable, for example, a great majority of the low loops on the Sun might be expected to be cool. How small perturbations evolve in low lying, linearly unstable hot loops was determined and how high lying, linearly stable hot loops respond to large amplitude disturbances such as might be expected on the Sun were examined. Only general descriptions and results are given.

12870 (N—88-11609, pp vp) **Solar transition region and coronal response to heating rate perturbations.** Mariska, J.T. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

The solar transition region is in a dynamic state characterized by impulsively upflowing plasma and continually downflowing plasma. Using numerical simulations, the conjecture that the areas of downflowing plasma are simply the base regions of coronal loops in which the heating rate is gradually decreasing and the areas of upflowing plasma are the base regions of coronal loops in which the heating rate is gradually increasing is examined. The calculations suggest that gradually reducing or increasing the heating in a magnetic flux tube will not result in plasma motions that are similar to those that are observed at high spatial resolution in the UV.

12871 (N—88-11609, pp vp) **Large-scale horizontal flows from SOUP observations of solar granulation.** November, L.J.; Simon, G.W.; Tarbell, T.D.; Title, A.M.; Ferguson, S.H. (Lockheed Missiles and Space Co., Palo Alto, CA). Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

Using high resolution time sequence photographs of solar granulation from the SOUP experiment on Spacelab 2, large scale horizontal flows were observed in the solar surface. The measurement method is based upon a local spatial cross correlation analysis. The horizontal motions have amplitudes in the range 300 to 1000 m/s. Radial outflow of granulation from a sunspot penumbra into surrounding photosphere is a striking new discovery. Both the supergranulation pattern and cellular structures having the scale of mesogranulation are seen. The vertical flows that are inferred by continuity of mass from these observed horizontal flows have larger upflow amplitudes in cell centers than downflow amplitudes at cell boundaries.

12872 (N—88-11609, pp vp) **Loop interaction in the visible emission corona: Morphological details.** Smartt, R.N.; Zhang, Z. (Nanjing Univ., China). Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

Coronagraph observations of two post flare loop systems, recorded photographically in the emissions of Fe 14 (5303 A) and Fe 10 (6374 A), show occasional enhancements at the intersections of some loops. The brightness of such enhancements in the green line gradually increases to a maximum value several times greater than that of the legs of the loops and then declines with a typical lifetime approx. 30 to 60 min. In red line emission the loop systems are usually very faint, but show the same overall type of enhancement, with a lag in maximum brightness relative to that of the green line approx. 10 min. The electron density, derived from the cooling time, is approx. 10 to the 12th power/cu cm.

12873 (N—88-11609, pp vp) **Sunspot observations from the SOUP instrument on Spacelab 2.** Shine, R.A.; Title, A.M.; Tarbell, T.D.; Acton, L.; Duncan, D.; Ferguson, S.H.; Finch, M.; Frank, Z.; Kelly, G.; Lindgren, R. Sep 1987. NTIS, PC A07/MF A01. (NASA-CP—2483; REPT—87B0401; NAS—1.55:2483; CONF-8609374—).

From 2. theoretical problems in high resolution solar physics; Boulder, CO, USA (15 Sep 1986).

A series of white light images obtained by the SOUP instrument on Spacelab 2 of active region 4682 on August 5, 1985 were analyzed in the area containing sunspots. Although the umbra of the spot is underexposed, the film is well exposed in the penumbral regions. These data were digitally processed to remove noise and to separate p-mode oscillations from low velocity material motions. The results of this preliminary investigation include: (1) proper motion measurements of a radial outflow in the photospheric granulation pattern just outside the penumbra; (2) discovery of occasional bright structures (streakers) that appear to be ejected outward from the penumbra; (3) broad dark clouds moving outward in the penumbra in addition to the well known bright penumbral grains moving inward; (4) apparent extensions and contractions of penumbral filaments over the photosphere; and (5) observation of a faint bubble or loop-like structure which seems to expand from two bright penumbral filaments into the photosphere.

12874 **(PB—88-114368/XAB) Solar-Geophysical Data Number 516, August 1987. Part 1 (prompt reports). Data for July 1987, June 1987, and late data.** (National Geophysical Data Center, Boulder, CO (USA)). Aug 1987. 93p. (SGD—516-PT-1). NTIS, PC A05/MF A01.

See also PB—87-233177 and PB—88-114376.

Contents include: Detailed index for 1986-1987; Data for July 1987-- (IUWDS alert periods (Advance and worldwide), Solar-activity indices, Solar flares, Solar radio emission, Stanford mean solar magnetic field); Data for June 1987-- (Solar-active regions, Sudden ionospheric disturbances, Solar radio-spectral observations, Cosmic-ray measurements by neutron monitor, Geomagnetic indices, Radio-propagation indices); Late data-- (Pioneer XII interplanetary magnetic field magnitudes Nov 86, Geomagnetic indices).

12875 **(PB—88-114376/XAB) Solar-Geophysical Data Number 516, August 1987. Part 2 (comprehensive reports). Data for February 1987.** (National Geophysical Data Center, Boulder, CO (USA)). Aug 1987. 59p. (SGD—516-PT-2). NTIS, PC A04/MF A01.

See also PB—88-114368 and PB—87-233185.

Contents include: Detailed index for 1986-1987; Data for February 1987-- (Meudon carte synoptique, Solar flares, Solar radio bursts at fixed frequencies, Solar x-ray radiation from GOES satellite, Active prominences and filaments); Miscellaneous data-- Cosmic-ray measurements by neutron monitor.

12876 **(RAL—87-075) Solar neutrinos.** Phillips, R.J.N. (Rutherford Appleton Lab., Chilton (UK)). Sep 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88751836/JAW.

The problem with solar neutrinos is that there seem to be too few of them, at least near the top end of the spectrum, since the /sup 37/Cl detector finds only about 35% of the standard predicted flux. Various kinds of explanation have been offered: (a) the standard solar model is wrong, (b) neutrinos decay, (c) neutrinos have magnetic moments, (d) neutrinos oscillate. The paper surveys developments in each of these areas, especially the possible enhancement of neutrino oscillations by matter effects and adiabatic level crossing. The prospects for further independent experiments are also discussed.

12877 **(UCRL—97699) Calculated late time spectra of supernovae.** Axelrod, T.S. (Lawrence Livermore National Lab., CA (USA)). 30 Oct 1987. Contract W-7405-ENG-48. 9p. (CONF-8709186—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003296/JAW.

From IAU colloquium No. 108 - atmospheric diagnostics of stellar evolution: chemical peculiarity, mass loss, and explosion; Tokyo, Japan (1 Sep 1987).

We consider here the nebular phase spectra of supernovae whose late time luminosity is provided by the radioactive decay of ^{56}Ni and ^{56}Co synthesized in the explosion. A broad variety of supernovae are known or suspected to fall in this category. This includes all SNIa and SNIb, and at least some SNII, in particular SN1987a. At sufficiently late times the expanding supernova becomes basically nebular in character due to its decreasing optical depth. The spectra produced during this stage contain information on the density and abundance structure of the entire supernova, as opposed to spectra near maximum light which are affected only by the outermost layers. A numerical model for nebular spectrum formation is therefore potentially very valuable for answering currently outstanding questions about the post-explosion supernova structure. As an example, we can hope to determine the degree of mixing which occurs between the layers of the "onion-skin" abundance structure predicted by current one dimensional explosion calculations. In the sections which follow, such a numerical model is briefly described and then applied to SN1972e, a typical SNIa, SN1985f, an SNIb, and finally to SN1987a. In the case of SN1987a predicted spectra are presented for the wavelength range from 1 to 100 microns at a time 300 days after explosion. 18 refs., 6 figs.

12878 **Phenomenological aspects of new gravitational forces. I. Rapidly rotating compact objects.** Nieto, M.M.; Goldman, T.; Hughes, R.J. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3684-3687(15 Dec 1987).

A general phenomenological feature of theories of quantum gravity is the existence of spin-1 and spin-0 partners of the graviton, which are expected to be massive (have finite ranges). In the static limit, the forces associated with these partners could almost cancel for particle-particle interactions and yet still produce dramatic effects for antiparticle-particle interactions (such as the gravitational attraction of antiprotons to Earth). However, at relativistic velocities the new forces could become significant even for particle-particle interactions. In this paper we show how these partners could modify the dynamics of particles at the surface of rotating, compact objects, specifically, rapidly rotating pulsars.

12879 **Phenomenological aspects of new gravitational forces. II. Static planetary potentials.** Nieto, M.M.; Goldman, T.; Hughes, R.J. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3688-3693(15 Dec 1987).

Theories of quantum gravity generically predict that there are vector and scalar partners of the graviton. These bosons produce new gravitational effects which, in general, tend to cancel in matter because the vector boson produces a repulsive force, whereas a scalar boson produces an attractive force. In this paper we derive the effects which these new interactions will produce in planets. In particular, static Yukawa potential theory is elucidated for massive (nonpointlike) objects.

12880 Early-Universe thermal production of not-so-invisible axions. Turner, M.S. (NASA/Fermilab Astrophysics Center, Fermilab National Accelerator Laboratory, Batavia, Illinois 60510). *Physical Review Letters;* **59**: No. 21, 2489-2492(23 Nov 1987).

We find that for Peccei-Quinn symmetry-breaking scales approx. <4 x 10⁵ GeV (corresponding to axion masses approx. >0.03 eV) thermal production of axions in the early Universe (via the Primakoff and photoproduction processes) dominates coherent production by a factor of about 1200 [m/sub a//(1 eV)]/sup 2.175/. The photon luminosity from the decays of these relic axions leads to an upper limit to the axion mass of order 2—5 eV. If the axion mass saturates this bound, relic axion decays may well be detectable.

12881 Variational study of ordinary and superconducting cosmic strings. Hill, C.T.; Hodges, H.M.; Turner, M.S. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510-0500). *Physical Review Letters;* **59**: No. 21, 2493-2496(23 Nov 1987).

We use a variational approach to study Abelian vortices, both the ordinary and bosonic superconducting variety. We present accurate results for the energy per length. For superconducting strings we map out the parameter space of solutions, quantify the critical current, discuss the quench transition, and investigate the possibility of static solutions where electromagnetic stresses balance the string tension.

12882 Supernova 1987A and the secret interactions of neutrinos. Kolb, E.W.; Turner, M.S. (Osservatorio Astronomico di Roma, via del Parco Mellini 84, 00136 Rome). *Physical Review [Section] D: Particles and Fields;* **36**: No. 10, 2895-2900(15 Nov 1987).

By using SN1987A as a "source" of neutrinos with energy app10 MeV we place limits on the couplings of neutrinos with cosmic background particles. Specifically, we find that the Majoron—electron-neutrino coupling must be less than about 10/sup -3/; if neutrinos couple to a massless vector particle, its dimensionless coupling must be less than about 10/sup -3/; and if neutrinos couple with strength g to a massive boson of mass M, then g/M must be less than 12 MeV/sup -1/.

12883 Weak resistance in superconducting cosmic strings. Barr, S.M.; Matheson, A.M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **36**: No. 10, 2905-2914(15 Nov 1987). Contract AC02-76CH00016.

We discuss how gauge interactions between fermionic charge carriers on superconducting cos- mic strings can lead to an effective string resistance and dissipation of energy from the current. We also examine possible astrophysical implications. We find that these processes are quite important for grand-unified gauge-boson exchange, when the charge carriers are heavy fermions. In many cases they lead to very restrictive limits on the current that superconducting strings can attain.

12884 Chiral-symmetry order parameter, the lattice, and nucleosynthesis. McLerran, L. (Fermi National Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **36**: No. 10, 3291-3293(15 Nov 1987).

I discuss an order parameter for the chiral-symmetry restoration phase transition which may be useful in computations of big-bang nucleosynthesis, a phenomenon which requires a finite baryon-number density. This parameter is strictly speaking an order parameter in the large-N limit, and distinguishes between a parity-doubled and a massless-fermion realization of chiral-symmetry restoration. This order parameter may be evaluated at a zero net baryon-number density at finite temperature, and is useful as long as the baryon chemical potential μ is much less than the temperature T.

12885 Examination of possible solar wind sources for a sudden brightening of comet Iras-Araki-Alcock. Russell, C.T.; Luhmann, J.G.; Baker, D.N. (Institute of Geophysics and Planetary Physics, University of California, Los Angeles). *Geophysical Research Letters;* **14**: No. 10, 991-994(Oct 1987).

Possible solar wind sources for a sudden global brightening of Comet IRAS-Araki-Alcock are examined. No increases in solar wind momentum flux, solar energetic particles or solar activity occurred coincident with these brightenings. The only change in the solar wind coincident with the brightenings was a rotation of the interplanetary magnetic field to a more flow-aligned state. If this rotation did not lead to the cometary brightening, the brightening must have been intrinsic to the comet. copyright American Geophysical Union 1987

12886 Stellar accretion of matter possessing angular momentum. Kutter, G.S.; Sparks, W.M. (Evergreen State College, Olympia, WA; Los Alamos National Lab., NM). *Astrophysical Journal;* **321**: 386-393(Oct 1987).

Observations of novae and theoretical results, in which the authors studied the nova outburst by radially accreting H-rich matter onto an He white dwarf, have convinced them that realistic nova models must be based on accretion that includes the angular momentum of the accreting matter. In the present paper the authors develop the theory of accretion onto stars of matter possessing angular momentum, including the shear forces between the accreting matter and the star (assumed to be nonrotating), distribution of accreted matter and its angular momentum by turbulent mixing, thermalizing of rotational kinetic energy, and loss of energy by horizontal expansion. 25 references.

12887 Nuclear runaways in a C/O white dwarf accreting H-rich material possessing angular momentum. Sparks, W.M.; Kutter, G.S. (Los Alamos National Lab., NM; Evergreen State College, Olympia, WA). *Astrophysical Journal;* **321**: 394-403(Oct 1987).

The nova outburst phenomenon is presently studied in light of the results of numerical calculations for the accretion of H-rich material onto 1-solar mass C/O white dwarfs, with arrival angular momentums of the order of 10-100 percent of the Keplerian values. The range of models investigated lies between the two limiting cases of radial accretion and accretion with Keplerian angular momentum. It is judged in view of the results obtained that certain important physical effects are being excluded; one of these may be the loss of angular momentum from the white dwarf's surface layers, either inwardly to the core or outwardly through the disk. 25 references.

12888 Limits on cold dark matter candidates from an ultralow background germanium spectrometer. Ahlen, S.P.; Avignone, F.T. III; Brodzinski, R.L.; Drukier, A.K.; Gelmini, G.; Spergel, D.N. (Boston Univ., MA, USA. Dept. of Physics; South Carolina Univ., Columbia, USA. Dept. of Physics; Battelle Pacific Northwest Labs., Richland, WA, USA; Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA; Applied Research Corp., Landover, MD, USA). *Physics Letters [Section] B;* **195**: No. 4, 603-607(17 Sep 1987). Contract AC06-76RL01830;AC02-82ER40073.

An ultralow background spectrometer is used as a detector of cold dark matter candidates form the halo of our galaxy. Using a realistic model for the galactic halo, large regions of the mass-cross section space are excluded for important halo component particles. In particular, a halo dominated by heavy standard Dirac neutrinos (taken as an example of particles with spin-independent Z/sup 0/ exchange interactions) with masses between 20 GeV and 1 TeV is excluded. The local density of heavy standard Dirac neutrinos is <0.4 GeV/cm/sup 3/ for masses between 17.5 GeV and 2.5 TeV, at the 68% confidence level.

12889 Resonant neutrino oscillations and the neutrino signature of supernovae. Walker, T.P.; Schramm, D.N. (Fermi National Accelerator Lab., Batavia, IL, USA. Astrophysics Group; Chicago Univ., IL, USA. Astronomy and Astrophysics Center). *Physics Letters [Section] B;* 195: No. 3, 331-336(10 Sep 1987).

We examine the effects of resonant neutrino oscillations, proposed as a solution to the solar neutrino puzzle, on the neutrino signature of a Type II supernova. We find that, for parameters corresponding to an adiabatic conversion of most of the /sup 8/B neutrino flux, the supernova neutrino signal in a water-Cerenkov detector is altered in the following way: (1) The isotropic-to-directional event ratio increases; (2) The short time scale neutronization burst signal decreases by a factor 7, perhaps rendering it unobservable. Detection of these changes would allow one to distinguish between neutrino oscillations and solar model alterations as solutions to the solar neutrino problem. We also note that mixing of the higher energy v/sub μ/ and v/sub r/'s to v/sub e/'s will enhance detection of the thermally produced v-flux.

12890 Collapse of 9 solar mass stars. Baron, E.; Cooperstein, J.; Kahana, S. (Steward Observatory, Tucson, AZ; New York State Univ., Stony Brook; Brookhaven National Lab., Upton). *Astrophysical Journal;* 320: 300-303(Sep 1987).

General relativistic hydrodynamical calculations of the collapse of O + Ne + Mg cores of a 9 solar mass star are reported. Collapse is induced by rapid electron captures as the O + Ne + Mg is burned to nuclear statistical equilibrium. The high entropy in the core after burning leads to a large abundance of free protons which readily capture electrons. This leads to large neutrino losses and a correspondingly small infalling homologous core. The hydrodynamic shock thus forms at a small mass point. The shock stalls before reaching the edge of the O + Ne + Mg core and thereby fails to produce a successful supernova explosion by the direct mechanism. No enhancement in the shock energy due to nuclear burning is found. 16 references.

12891 Collapsing white dwarfs. Baron, E.; Cooperstein, J.; Kahana, S.; Nomoto, K. (Steward Observatory, Tucson, AZ; New York, State Univ., Stony Brook; Brookhaven National Lab., Upton). *Astrophysical Journal;* 320: 304-307(Sep 1987).

The results of the hydrodynamic collapse of an accreting C + O white dwarf are presented. Collapse is induced by electron captures in the iron core behind a conductive deflagration front. The shock wave produced by the hydrodynamic bounce of the iron core stalls at about 115 km, and thus a neutron star formed in such a model would be formed as an optically quiet event. 19 references.

12892 Prospects for observations of nucleosynthetic gamma-ray lines and continuum from SN 1987A. Gehrels, N.; Maccallum, C.J.; Leventhal, M. (NASA, Goddard Space Flight Center, Greenbelt, MD; Sandia National Lab., Albuquerque, NM; AT & T Bell Labs., Murray Hill, NJ). *Astrophysical Journal;* 320: L19-L22(Sep 1987).

Expected flux levels for nucleosynthetic gamma-ray line and continuum emissions from SN 1987A are calculated for several models. The dominant line emission is from freshly synthesized Ni-56 and its decay daughters, and the continuum is from Compton scattering of line photons. For a 15 solar mass Type II model, the light curve for the 0.847 MeV gamma-ray line peaks in September 1988 at 3 x 10 to the -4th photons/sq cm/s. This is detectable only by new, ultrasensitive balloon-borne spectrometers. For models with substantial mass loss from their envelopes, the peak is in early 1988 at about 0.01 photons/sq cm/s, which is detectable at high significance levels by all current instruments. The continuum emission in the 0.05-0.5 MeV band peaks about 100 days before the 0.847 MeV line peak. This Compton precursor is observable at about the same significance level as the lines. 18 references.

12893 Rapid optical flaring in MXB 1735-444 and an optical burst from GX 17+2. Imamura, J.N.; Steiman-Cameron, T.Y.; Middleditch, J. (Oregon Univ., Eugene; Los Alamos National Lab., NM; Joint Institute for Lab. Astrophysics, Boulder, CO). *Astrophysical Journal;* 320: L41-L45(Sep 1987).

DOE-supported research.

The results of high-speed white-light photometry of five low-mass X-ray binaries (LMXB), including MXB 1735-444 (V926 Sco), are reported. It is found that MXB 1735-444 was in a previously unreported state. It showed rapid optical flaring on time scales of 10 s or less to about 20 minutes over the course of a 2 hr observation. During the bursts, the optical luminosity increased by up to a factor of five; the average optical luminosity of MXB 1735-444 was about 2 x 10 to the 34th ergs/s at these times. Qualitatively similar long type II X-ray bursts have been observed from the rapid burster, MXB 1730-335, and long X-ray bursts of undetermined type have been observed from GX 17+2 (4U 1813-14). The detection of an optical burst from the source GX 17+2 is also reported. Optical bursts have not been previously reported in this object. 21 references.

12894 Quantum synchrotron spectra from semirelativistic electrons in teragauss magnetic fields. Brainerd, J.J. (Lawrence Livermore National Lab., CA). *Astrophysical Journal;* 320: 714-725(Sep 1987).

Synchrotron spectra are calculated from quantum electrodynamic transition rates for thermal and power-law electron distributions. It is shown that quantum effects appear in thermal spectra when the photon energy is greater than the electron temperature, and in power-law spectra when the electron energy in units of the electron rest mass times the magnetic field strength in units of the critical field strength is of order unity. These spectra are compared with spectra calculated from the ultrarelativistic approximation for synchrotron emission. It is found that the approximation for the power-law spectra is good, and the approximation for thermal spectra produces the shape of the spectrum accurately but fails to give the correct normalization. Single photon pair creation masks the quantum effects for power-law distributions, so only modifications to thermal spectra are important for gamma-ray bursts. 13 references.

12895 Localization, time histories, and energy spectra of a new type of recurrent high-energy transient source. Atteia, J.L.; Boer, M.; Hurley, K.; Niel, M.; Vedrenne, G.; Fenimore, E.E.; Klebesadel, R.W.; Laros, J.G.; Kuznetsov, A.V.; Kouveliotou, C. (Centre d'Etude Spatiale des Rayonnements, Toulouse, France; Los Alamos National Lab., NM; AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR; NASA, Goddard Space Flight Center, Greenbelt, MD). *Astrophysical Journal;* 320: L105-L110(Sep 1987).

CNES-DOE-supported research.

The detection of a recurrent high-energy transient source which is neither a classical X-ray nor a gamma-ray burster, but whose properties are intermediate between the two, is reported. The energy spectra of 12 recurrent events are found to be soft, characterized by kT's of 34-56 keV. The time histories are short with rise and fall times as fast as about 10 ms. The source location is a 0.12 sq deg region about 10 deg from the Galactic center. 21 references.

12896 New type of repetitive behavior in a high-energy transient. Laros, J.G.; Fenimore, E.E.; Klebesadel, R.W.; Atteia, J.L.; Boer, M.; Hurley, K.; Niel, M.; Vedrenne, G.; Kane, S.R.; Kouveliotou, C. (Los Alamos National Laboratory, NM; Centre d'Etude Spatiale des Rayonnements, Toulouse, France; California Univ., Berkeley; NASA, Goddard Space Flight Center, Greenbelt, MD). *Astrophysical Journal;* 320: L111-L115(Sep 1987).

DOE-CNES-supported research.

The high-energy burster GB 790107 has been observed to repeat, on the order of 100 times, between August 13, 1978 and June 27, 1986, with most repetitions occurring in the latter part of 1983. Here, these activities are described, discussing intensity and time-of-occurrence information covering a seven-year span of International Cometary Explorer (ICE) data. Arguments for the reality of this activity and its association with the GB 790107 source are presented. A moderately precise location derived from ICE, SMM, Pioneer Venus Orbiter, and Venera 13 Signe data is given and related to the published GB 790107 location. 9 references.

12897 **Polyoxymethylene in Comet Halley.** Huebner, W.F.; Boice, D.C.; Sharp, C.M. (Southwest Research Institute, San Antonio, TX; Los Alamos National Lab., NM). *Astrophysical Journal;* 320: L149-L152(Sep 1987).

NASA-supported research.

It is shown that polyoxymethylene (POM) with n about four or five explains the mass spectrum obtained with the PICCA instrument during the Giotto encounter with Comet Halley. A sequence of processes is presented showing the likelihood that POM will form under interstellar conditions. A preliminary comet coma model that includes POM is presented which predicts a qualitatively correct spectral intensity behavior when compared with observations. 19 references.

12898 **Accelerator mass spectrometry of heavy elements: /sup 36/Cl to /sup 205/Pb.** Henning, W. (Argonne National Lab., IL, USA; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.). *Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences;* 323: No. 1569, 87-99(25 Aug 1987).

Measurements are discussed in which the technique of accelerator mass spectrometry was applied to problems involving heavy radioisotopes. These measurements, which depend on the ion energies that can be reached with the new heavy-ion accelerator facilities, were performed at the Argonne tandem linac accelerator system (ATLAS) and at the UNILAC accelerator at GSI. The topics include a discussion of measurements of long nuclear lifetimes, of radioisotope detection of interest to solar neutrino experiments, and of a determination of the /sup 41/Ca concentration in natural samples of terrestrial origin by making use of isotopic preenrichment in an isotope separator. A long-known method of isobar separation, employing a gas-filled magnetic field region, has been revived for some of these measurements and its characteristics and advantages are briefly reviewed.

12899 **Comparison between mass-losing and standard solar models.** Guzik, J.A.; Willson, L.A.; Brunish, W.M. (Iowa State Univ. of Science and Technology, Ames; Los Alamos National L., NM). *Astrophysical Journal;* 319: 957-965(Aug 1987).

The effects of main-sequence mass loss on the evolution, interior structure, and surface composition of the sun are studied. Modeling results are presented for three mass-losing solar models of initial mass two solar, plus a standard one solar mass comparison model. It is shown that the solar models can be evolved to produce present-day solar models that do not differ radically in structure and composition from standard solar models. The mass-losing models require low initial He-4 abundances and predict high surface He-3 abundances that are near the limits, yet still within the bounds, of observational estimates. The mass-losing models have somewhat higher B-8 neutrino fluxes, but standard solar models also fail to reproduce observations by a wide margin. For mass-losing models, protosolar Li and Be are completely destroyed, requiring a mechanism for partial replenishment to observed surface abundances. 34 references.

12900 **Nuclear information needs for the astrophysical s-process.** Mathews, G.J.; Howard, W.M.; Takahashi, K.; Ward, R.A. (California Univ., Livermore, USA. Lawrence Livermore National Lab.). *Radiation Effects;* 94: No. 1-4, 253-258(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The astrophysical s-process is a sequence of neutron-capture and beta-decay reactions on a slow time scale compared to beta-decay lifetimes near the line of stability. This detailed sequence of neutron capture, continuum and bound-state beta decay, positron decay, and electron-capture reactions that comprise the s-process has been studied for a broad range of astrophysical environments. The results are then compared with the solar-system abundancies of heavy elements to determine the range of physical conditions responsible for their nucleosynthesis. The nuclear data needs are extensive but have begun to be precise enough to allow for a consistent interpretation of the astrophysical site for the s-process.

12901 **Berkeley search for a faint stellar companion to the Sun.** Perlmutter, S.; Burns, M.S.; Crawford, F.S.; Friedman, P.G.; Kare, J.T.; Muller, R.A.; Pennypacker, C.R.; Williams, R.W. (Lawrence Berkeley Lab., CA, USA). pp 87-92 of Astrophysics of brown dwarfs. Proceedings of a workshop held at George Mason University Fairfax, Virginia, October 14-15 1985. Kafatos, M.C.; Harrington, R.S.; Maran, S.P. (eds.). Cambridge, England; Cambridge University Press (1986). (CONF-8510451—).

From Astrophysics of brown dwarfs; Fairfax, VA, USA (14 Oct 1985).

Price Pound 25.00.

Based on considerations of wide-binary-star stability, it is reasonable to look as far as 1 to 2 pc for a stellar companion to the sun. The authors have developed an automated telescope and image analysis system for finding such a high-parallax star among many faint candidates. It is possible to detect (at 3σ) parallactic motion $>0.75''$, corresponding to a companion closer than 2.6 pc. The candidate list consists of approx.5000 late M stars, but our current system would allow us to include any additional sources down to msub(v) =16.5, or a Jupiter-size black body of 1600 K at our limiting distance. Approx. 90% of the first epoch images have been collected and the image processing has been tested on a hundred fields taken months apart.

12902 **Large-scale anisotropy of the cosmic background radiation at 3mm.** Lubin, P.; Villela, T. (Lawrence Berkeley Lab., Univ. of California, Berkeley). pp 383 of Proceedings of the 12th Texas symposium on relativistic astrophysics. Livio, M.; Shaviv, G. New York, NY; The N.Y. Academy of Sciences (1986). (CONF-841238—).

From 12. Texas symposium of relativistic astrophysics; Jerusalem, Israel (17 Dec 1984).

The large-scale structure of the cosmic background has been measured at 3 mm wavelength using a balloon-borne liquid-helium cooled radiometer. Flights from both hemispheres have achieved a sky coverage of over 85% with very little galactic contamination. Other than a first order dipole and a possible faint galactic contribution, no other structure is apparent. All quadrupole components are 100 μK or less, with errors of 50-80 μK. A 90% confidence level upper limit of 6 x 10/sup -5/ RMS is placed on a quadrupole component. A possible detection of galactic dust has been obtained with a cosec (b) (b-galactic latitude) model giving 40 +- 11 μK at the pole. This galactic component contributes less than 100 μK to the quadrupole component. A map of the sky has been prepared.

12903 **Stellar core collapse and supernovae.** Wilson, J.R.; Mayle, R.; Woosley, S.E.; Weaver, T. (Lawrence Livermore National Lab., Livermore, CA 94550). pp 267-293 of Proceedings of the 12th Texas symposium on relativistic astrophysics. Livio, M.; Shaviv, G. New York, NY; The N.Y. Academy of Sciences (1986). (CONF-841238—).

From 12. Texas symposium of relativistic astrophysics; Jerusalem, Israel (17 Dec 1984).

Massive stars that end their stable evolution as their iron cores collapse to a neutron star or black hole have long been considered good candidates for producing Type II supernovae. For many years, the outward propagation of the shock wave produced by the bounce of these iron cores has been studied as a possible mechanism for the explosion. For the most part, the results of these studies have not been particularly encouraging, except, perhaps in the case of very low mass iron cores or very soft nuclear equations of state. The shock stalls, overwhelmed by photodisintegration and neutrino losses, and the star does not explode. More recently, slow late time heating of the envelope of the incipient neutron star has been found to be capable of rejuvenating the stalled shock and producing an explosion after all. The present paper discusses this late time heating and presents results from numerical calculations of the evolution, core collapse, and subsequent explosion of a number of recent stellar models. For the first time, they all, except perhaps the most massive, explode with reasonable choices of input physics.

12904 **Cosmology and particle physics: A general review.** Olive, K.A. (Astrophysics Theory Group, Fermilab, Batavia, IL 60510). pp 1-25 of Proceedings of the 12th Texas symposium on relativistic astrophysics. Livio, M.; Shaviv, G. New York, NY; The N.Y. Academy of Sciences (1986). (CONF-841238—).

From 12. Texas symposium of relativistic astrophysics; Jerusalem, Israel (17 Dec 1984).

Cosmology today does not stop at t = 1 s. Indeed, "reasonable" statements begin at the Planck epoch or when t ≅ 10/sup -44/ s. In this review, the author attempts to highlight the current understanding of the various stages in the evolution of the universe from — 10/sup -4/s to the period of galaxy formation at t≅10/sup 5/ years. He tries to follow a chronological order for the discussion and begins with the Planck epoch. In the section entitled INFLATION, discusses the inflationary epoch. In the section, GUTs and COSMOLOGY, he reviews the present status of big bang baryosynthesis, i.e., the origin of the apparent slight excess of baryons over antibaryons. This is perhaps the third most reliable piece of evidence indicating a hot big bang. He also reviews the present status of big bang nucleosynthesis and discuss why he feels it is one of the greatest successes of the standard big bang model. Finally, in the last section, he reviews the present role of particles in the universe; that is, their effects on galaxy formation and constraints from present observations that can be placed on particle properties.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 12272, 12874

12905 **(AD-A—184809/2/XAB) Analysis of geophysical data bases and models for spacecraft interactions. Final technical report, August 1983-October 1986.** Bass, J.N.; Bonito, N.A.; Cottrell, K.G.; Eckhardt, R.J.; McNeil, W.J. (Radex, Inc., Carlisle, MA (USA)). 31 Oct 1986. 276p. NTIS, PC A13/MF A01.

This contract supported on-going as well as planned research into environments and spacecraft interactions in near space. The major projects are summarized in this report. Models and geophysical data bases were investigated for spacecraft charging, shuttle contamination, electrostatic particle pushing codes, beam-plasma interaction in emitting probes, magnetospheric dynamics, adiabatic invariance of trapped particles, fluxgate magnetometer simulation and falling-sphere accelerometers. In support of the CRRES project, a data management plan was provided, and a graphics capability was developed for the SPAN network. Software development was involved in all phases, using CYBER, VAX and RIDGE computers.

12906 **(AD-A—185043/7/XAB) Satellite observations of extreme ultraviolet radiation. Final report, 22 April-31 May 1976.** Bowyer, S. (California Univ., Berkeley (USA)). 11 May 1987. 8p. NTIS, PC A02/MF A01.

The first Extreme UltraViolet (EUV) spectrometer (ECOM-721) was flown on the DOD satellite P78-1. The instrument collected a large amount of high-quality data on the Earth's atmosphere, ionosphere and magnetosphere. It is still the only such experiment performed from a satellite. Because the instrument was on a spinning satellite, in a noon-midnight polar orbit at 600km altitude, it obtained a huge amount of unique data of geophysical interest. A substantial number of important geophysical observations were made, including the first spectrum of the polar cusp under sunlight, the first spectrum of the EUV nightglow emissions, the first spectrum of the tropical airglow in the EUV, the first spectrum of the nightside aurora below 800A, the detection of dielectronic recombination emissions in the atmosphere, and the first spectrum of the polar-cap emissions in the EUV.

12907 **(AD-A—185386/0/XAB) Polar ionosphere and interplanetary field. Final report, 1 July 1985-30 June 1987.** Watkins, B.J.; Akasofu, S.I. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). Aug 1987. 42p. NTIS, PC A03/MF A01.

The model ionosphere was developed that is coupled to a magnetospheric model for investigating time-dependent behavior of the polar F-region ionosphere in response to varying interplanetary magnetic field (IMF) configurations. The numerical ionospheric model covers a latitude range from 50 to 90° and an altitude range of 150 to 600 kM. The purpose of the magnetospheric model is to define the location and geometry of the polar cap, which is defined as the region of open-field lines. The polar-cap configuration was coupled to a model electric-field pattern that in turn may vary in size and strength in response to the IMF. The ionosphere model assumes only oxygen ions; the ion density is solved vertically along many magnetic field lines as they move horizontally under the influence of the large-scale convective electric fields. The lower boundary is defined by the local chemistry and the upper boundary condition is set by applying an outward flux of ions appropriate for open-field-line conditions. The model has been used to illustrate ionospheric behavior during geomagnetic-storms conditions. Future model applications may include ionospheric prediction using IMF inputs improved understanding of polar-ionization structures.

12908 **(AD-A—185437/1/XAB) Observations of electron-cyclotron harmonic emissions associated with field-aligned electron beams. Technical report.** Koons, H.C.; Edgar, B.C.; Fennell, J.F.; Gorney, D.J. (Aerospace Corp., El Segundo, CA (USA). Laboratory Operations). 1 Jul 1987. 29p. (TR—0086(6940-06)-13). NTIS, PC A03/MF A01.

Several cases have been found in plasma-wave and electron-distribution-function data from the SCATHA satellite in which strong gyrofrequency emissions near 1.5 times the local electron gyrofrequency, f/sub g/, correlate in time with field-aligned electron beams. The energy of the electron beams ranges from 100 to 800 eV. Before the beam appears, the emissions are observed at a lower frequency, typically 1.1 to 1.2 f/sub g/. As the beam develops, the emissions rise in frequency and grow in amplitude. Above 2 keV, the electrons had a normal loss-cone distribution. This loss cone deepened by a small amount when the beams appeared at lower energy. These observations were made near local midnight between L=7.0 and 7.8 R/sub e/.

12909 **(OUP—87-30) Auroral and magnetic variations in the polar cusp and cleft. Signatures of magnetopause boundary layer dynamics.** Sandholt, P.E.; Egeland, A. (Oslo Univ. (Norway). Fysisk Inst.). Oct 1987. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751312/JAW.

By combining continous ground-based observations of polar cleft/cusp auroras and local magnetic variations with electromagnetic parameters obtained from satellites in polar orbit (low-altitude cleft/cusp) and in the magnetosheath/interplanetary space, different electrodynamic processes in the polar cleft/cusp have been investigated. One of the more controversial questions in this field is related to the observed shifts in latitude of cleft/cusp auroras and the relationships with the interplanetary magnetic field (IMF) orientation, local magnetic disturbances (DP2 and DPY modes) and magnetospheric substorms. A new approach which may contribute to clarifying these complicated relationships, simultaneous ground-based observations of the midday and evening-midnight sectors of the auroral oval, is illustrated. A related topic is the spatial relationship between the cleft/cusp auroras and the ionospheric convection currents. A characteristic feature of the polar cusp and cleft regions during negative IMF B/sub z/ is repeated occurrence of certain short-lived auroral structures moving in accordance with the local convection pattern. Satellite measurements of particle precipitation, magnetic field and ion drift components permit detailed investigations of the electrodynamics of these cusp/cleft structures. Information on electric field components, Birkeland currents, Poynting flux, height-integrated Pedersen conductivity and Joule heat dissipation rate has been derived. These observations are discussed in relation to existing models of temporal plasma injections from the magnetosheath. 75 refs.

12910 **(PB—88-115399/XAB) Kiruna Geophysical Data: data summary 87/1-3, January-March 1987.** Thelin, B. (Kiruna Geophysical Inst. (Sweden)). 1987. 58p. NTIS, PC E04/MF A01.

See also PB—87-158135.

Kiruna Geophysical Data is a collection of results of ground-based more-or-less continuous measurements of upper-at-

mosphere variables carried out at the Swedish Institute of Space Physics. The objective with this data summary is to present current geophysical data related to polar upper-atmospheric conditions for those who require it for their research work. Topics include geomagnetism, optical aurora, and ionospheric ionization.

12911 **Highly relativistic magnetospheric electrons: A role in coupling to the middle atmosphere?.** Baker, D.N.; Blake, J.B.; Gorney, D.J.; Higbie, P.R.; Klebesadel, R.W.; King, J.H. (Los Alamos National Laboratory, Los Alamos, NM 87545). *Geophysical Research Letters;* 14: No. 10, 1027-1030(Oct 1987).

Long-term (1979-present) observations of relativistic electrons (2—15 MeV) at geostationary orbit show a strong solar cycle dependence. Such electrons were largely absent near the last solar maximum (1979—80), while they were prominent during the approach to solar minimum (1983—85). This population now is dwindling as solar minimum has been reached. The strong magnetospheric presence of high-speed solar wind streams which results from solar coronal hole structures during the approach to solar activity (sunspot) minimum. We clearly observe 27-day periodic enhancements of the relativistic electrons in association with concurrently measured solar wind streams (V/sub S//sub W/approx. >600 km/s). We have used a numerical transport code to study the coupling of these high-energy electrons to earth's upper and middle atmosphere. We calculate using the observed energy spectra of the electrons that, when precipitated, these electrons show a large (maximum of ~100 keV/cm^3-s) energy deposition at 40—60 km altitude, which is 3—4 orders of magnitude greater than the galactic cosmic ray or solar EUV energy deposition at these altitudes. We also find that the global energy deposition in the mid-latitudes totals nearly 10^{21} ergs for a typical 2—3 day event period. We conclude that this previously unrecognized electron population could play an important role in coupling solar wind and magnetospheric variability (on 27—day and 11—year cycles) to the middle atmosphere through a modulating effect on lower D-region ionization and, possibly, on upper level ozone chemistry. These electrons also may contribute to the recent Antarctic polar ozone depletion phenomenon. copyright American Geophysical Union 1987

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REFER ALSO TO CITATION(S) 11148, 11804, 12019, 12098, 12219, 13252, 13368, 13431, 13479, 13559, 13574, 13761

12912 **(AD-A—185069/2/XAB) Dynamics of gas-phase reactions of muonium.** Garrett, B.C.; Steckler, R.; Truhlar, D.G. (Chemical Dynamics Corp., Upper Marlboro, MD (USA)). 1986. 17p. NTIS, PC A03/MF A01.

Pub. in Hyperfine Interactions, Vol. 32, 779-794(1986).

Applications of variational-transition-state theory with semiclassical adiabatic transmission coefficients to the reactions of muonium with H_2, D_2, F_2, and Cl_2 are reviewed. In addition, new calculations are presented for the Mu + Cl_2 and Br_2 reactions. The comparison of calculated rate constants and kinetic isotope effects (KIE's) with experiment is used as a test of the validity of semiempirical potential energy surfaces. Furthermore the VTST-plus-tunneling calculations allow an analysis of the KIE's that identifies those features of the potential which control the isotope effects.

12913 **(AD-A—185070/0/XAB) Dynamics calculations of kinetic isotope effects for the reactions of muonium atoms with F_2 and Cl_2.** Steckler, R.; Truhlar, D.G.; Garrett, B.C. (Chemical Dynamics Corp., Upper Marlboro, MD (USA)). 1986. 13p. NTIS, PC A03/MF A01.

Pub. in Internation Jnl. of Quantum Chemistry, Vol. 20, 495-506(1986).

Variational-transition-state theory with semiclassical ground-state transmission coefficients is applied to calculate reaction rate constants, activation energies, and kinetic isotope effects for the protium (H) and muonium (Mu) cases of H + F_2 to HF + F and H + Cl_2 to HCl + Cl. The authors examine four potential energy surfaces for H + F_2 and two for H + Cl_2. For H + F_2 there is an unresolved difference between the available experiments; the calculations are consistent with the Mu experiments of Fleming and coworkers and with the H experiment of Albright et al., but not with the H experiment of Homann et al. For H + Cl_2 the calculations based on the surface of Polanyi and coworkers are in good agreement with experiment, but those based on the surface of Last and Baer are not. For both reactions, the Mu rate constants and the kinetic isotope effects are greatly enhanced by tunneling.

12914 **(AD-A—185197/1/XAB) Extreme-ultraviolet beam-foil spectroscopy of highly ionized neon and argon. Final report.** Demarest, J.A. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Jun 1987. 190p. (AFWL-TR—87-26). NTIS, PC A09/MF A01.

A study of the extreme-ultraviolet radiation emitted by ion beams of highly ionized neon and argon after passage through thin foils was conducted at the variable-energy cyclotron at Texas A&M University. A grazing-incidence spectrometer was equipped with a position-sensitive microchannel plate (MCP) detector, which improved the detection efficiency by two orders of magnitude. The position information of the MCP was determined to be linear over 90% of the 50-mm-wide detector. Spectra-spanning regions of over 100 angstroms were accumulated at a resolution of less than 1 angstrom. A wavelength calibration based on a second-order equation of spectrometer position was found to result in an accuracy of + 0.1 angstroms.

12915 **(BNL—40287) Experiments in atomic and applied physics using synchrotron radiation.** Jones, K.W. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 29p. (CONF-8705201—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001338/JAW.

From 22. Zakopane school of physics; Zakopane, Poland (1 May 1987).

A diverse program in atomic and applied physics using x rays produced at the X-26 beam line at the Brookhaven National Synchrotron Light Source is in progress. The atomic physics program studies the properties of multiply-ionized atoms using the x rays for photo-excitation and ionization of neutral atoms and ion beams. The applied physics program builds on the techniques and results of the atomic physics work to develop new analytical techniques for elemental and chemical characterization of materials. The results are then used for a general experimental program in biomedical sciences, geo- and cosmochemistry, and materials sciences. The present status of the program is illustrated by describing selected experiments. Prospects for development of new experimental capabilities are discussed in terms of a heavy ion storage ring for atomic physics experiments and the feasibility of photoelectron microscopy for high spatial resolution analytical work. 21 refs., 11 figs., 2 tabs.

12916 **(CONF-870789—4) Photoelectron studies of multiphoton processes in small molecules.** Pratt, S.T.; O'Halloran, M.A.; Tomkins, F.S.; Dehmer, J.L.; Dehmer, P.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002980/JAW.

From International conference on multiphoton processes; Boulder, CO, USA (13 Jul 1987).

The three photon resonant, four photon ionization (3 + 1) spectra of H_2 via $^1\pi$/sub u/, v' = 0 - 4 levels display strong non-Franck-Condon behavior that is not reproduced by calculations that assume direct excitation from the C $^1\pi$/sub u/ Rydberg state into the ionization continuum. Recently, an explanation for this behavior has been proposed that involves an autoionizing, doubly-excited electronic state at the four photon energy. This explanation is examined in light of new (3 + 1) spectra obtained via the C $^1\pi$/sub u/, v' = 5, 6 levels and new (3 + 1) spectra obtained via the C $^1\pi$/sup u/, v' = 0 - 4 levels of D_2. The new data support the explanation based on autoionization of a doubly excited state. 23 refs., 6 figs.

12917 (CONF-870873—20) Suppression of the mass enhancement in CeB_6 in high magnetic fields. Joss, W.; van Ruitenbeek, J.M.; Crabtree, G.W.; Tholence, J.L.; van Deursen, A.P.J.; Fisk, Z. (Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (Germany, F.R.); Centre National de la Recherche Scientifique, 38 - Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures; Technische Univ. Eindhoven (Netherlands); Los Alamos National Lab., NM (USA)). Aug 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002946/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

The effective mass of the itinerant electrons in the Kondo lattice system CeB_6 is found to be strongly field dependent. Measurements of the de Haas-van Alphen effect at temperatures down to 60 mK in steady magnetic fields up to 22 T show a change of more than 100% in the cyclotron effective mass, decreasing with increasing field. The origin of the effect is not known but it is noted that a field of about 10 T corresponds to the energy scales in the system. 7 refs., 1 fig.

12918 (CONF-871147—1) The suppression of stimulated hyper-Raman emission in Na due to parametric four-wave mixing. Moore, M.A.; Garrett, W.R.; Payne, M.G. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003290/JAW.

From 3. international laser science conference; Atlantic City, NJ, USA (1 Nov 1987).

We show that an interference effect involving four-wave mixing can almost totally suppress predicted examples of stimulated hyper-Raman emission in the forward direction of a laser pump beam. The effect is demonstrated in Na vapor. 6 refs., 3 figs.

12919 (CONF-8706187—, pp 206-208) WKB evolution of wave packets. Littlejohn, R.B. (Lawrence Berkeley Lab., CA). Jun 1987. NTIS, PC A12/MF A01. Order Number DE88001479/JAW.

From 5. Symposium on energy engineering sciences; Argonne, IL, USA (17 Jun 1987).

Wave packet methods constitute a new approach to WKB theory, and provide both a new theoretical tool and a new way of solving practical problems. They are especially useful for complex geometries in several dimensions. Their main advantage is the ease with which they deal with caustics and Maslov phase shifts, and the fact that they do not suffer from any discontinuities or divergences.

12920 (CONF-8707133—1) Photoionization dynamics of excited molecular states. Dehmer, J.L.; O'Halloran, M.A.; Tomkins, F.S.; Dehmer, P.M.; Pratt, S.T. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03. Order Number DE88002982/JAW.

From International electron molecule scattering and photoionization meeting; Daresbury, UK (18 Jul 1987).

Resonance Enhanced Multiphoton Ionization (REMPI) utilizes tunable dye lasers to ionize an atom or molecule by first preparing an excited state by multiphoton absorption and then ionizing that state before it can decay. This process is highly selective with respect to both the initial and resonant intermediate states of the target, and it can be extremely sensitive. In addition, the products of the REMPI process can be detected as needed by analyzing the resulting electrons, ions, fluorescence, or by additional REMPI. This points to a number of opportunities for exploring excited state physics and chemistry at the quantum-state-specific level. Here we will first give a brief overview of the large variety of experimental approaches to excited state phenomena made possible by REMPI. Then we will examine in more detail, recent studies of the three photon resonant, four photon (3 + 1) ionization of H_2 via the C $^1\Pi_u$ state. Strong non-Franck-Condon behavior in the photoelectron spectra of this nominally simple Rydberg state has led to the examination of a variety of dynamical mechanisms. Of these, the role of doubly excited autoionizing states now seems decisive. Progress on photoelectron studies of autoionizing states in H_2, excited in a (2 + 1) REMPI process via the E, F $^1\Sigma_g^+$ will also be briefly discussed. 26 refs., 7 figs.

12921 (CONF-8708164—3) High-precision hyperfine structure measurement in slow atomic ion beams by collinear laser-rf double resonance. Amarjit Sen, Childs, W.J.; Goodman, L.S. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002985/JAW.

From International conference on spectroscopy and structure of highly ionized atoms; Lisle, IL, USA (17 Aug 1987).

A new collinear laser-ion beam apparatus for slow ions (1 to 1.5 keV) has been built for measuring the hyperfine structure of metastable levels of ions with laser-rf double resonance technique. Narrow linewidths of ~60 kHz (FWHM) have been observed for the first time in such systems. As a first application the hyperfine structure of the $4f^7(^8S^o)5d\ ^9D_{J^o}$ metastable levels of $^{151,153}Eu^+$ has been measured with high precision. 10 refs., 8 figs.

12922 (CONF-8708164—4) Isotope shift in $^{151,153}Eu^+$ from high-precision hyperfine structure measurements. Sen, A.; Childs, W.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002977/JAW.

From International conference on spectroscopy and structure of highly ionized atoms; Lisle, IL, USA (17 Aug 1987).

Isotope shift in the two stable isotopes of Eu^+ has been obtained for four optical transitions between the states $4f^7(^8S^o)5d\ ^9D_{J^o}$ and $4f^7(^8S_{7/2})6p_{3/2;J'}$ using high-precision hyperfine structure measurements in a collinear laser and slow ion beam (1.35 keV) apparatus. 5 refs., 2 figs., 1 tab.

12923 (CONF-8709135—9) A study of vibronic coupling in the tilde C state of CO_2i. Roy, P.; Ferrett, T.A.; Schmidt, V.; Parr, A.C.; Southworth, S.H.; Hardis, J.E.; Bartlett, R.; Trela, W.; Dehmer, J.L. (Los Alamos National Lab., NM (USA); National Bureau of Standards, Washington, DC (USA); Freiburg Univ. (Germany, F.R.). Fakultaet fuer Physik; Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003372/JAW.

From 14. international conference on X-ray and inner-shell processes; Paris, France (14 Sep 1987).

We have studied vibronic coupling in vibrationally resolved photoionization to the fourth electronic state of CO_2^+, $C(^2\Sigma_g^+)$, in the photon-energy range h nu = 20 to 28.5 eV. The measurements utilize high-resolution hemispherical electron analyzers, equipped with area detectors, and the SURF-II synchrotron radiation source at the National Bureau of Standards. The angular distribution asymmetry-parameters (β) for the allowed C(0,0,0) and forbidden C(1,0,1) (19.747 eV binding energy) peaks are found to be quite different. However, similarities between the C(1,0,1) β curve and that for the B state suggest that vibronic coupling to the $B(^2\Sigma_u^+)$ state of CO_2^+ is the explanation for the intensity of the C state forbidden band in the first 8 eV above threshold.

12924 (CONF-8710230—1) Physics with fast molecular ions. Gemmell, D.S.; Faibis, A.; Kanter, E.P.; Vager, Z.; Zabransky, B.J. (Argonne National Lab., IL (USA); Weizmann Inst. of Science, Rehovoth (Israel)). 1987. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003085/JAW.

From International symposium on applications of ion beam by small accelerators; Jinan, China (20 Oct 1987).

Argonne's 5-MV Dynamitron accelerator is currently being used to study the interactions of fast (MeV) atomic and molecular ions with matter. The present emphasis of the work is upon the problem of determining the stereochemical structures of molecular-ion projectiles. The technique is based upon the "Coulomb explosion" of these projectiles when they strike a thin-foil target. By making careful determinations of the momenta of all of the fragments emitted from these Coulomb explosions, one can infer the original configuration of the molecular constituents in the projectile and, in favorable cases, their vibrational motions. This technique is particularly useful for those cases where the more traditional spectroscopic approaches cannot be applied. During the past year, new ideas and developments in the Coulomb-explosion technique have come to fruition. Radically new multiparticle detectors have been developed and implemented. Extremely thin film targets have been

produced which reduce the "blurring" effect of multiple scattering, and a low-excitation ion source has been installed. These developments have resulted in direct measurements of the complete stereostructures of several small polyatomic molecular ions. In this paper we describe the experimental techniques, discuss some of the difficulties, and present some recent results. 19 refs., 5 figs.

12925 (CONF-8711107—2) **Application of ECR ion source beams in atomic physics.** Meyer, F.W. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003767/JAW.

From International conference on ECR ion sources and their applications; East Lansing, MI, USA (16 Nov 1987).

The availability of intense, high charge state ion beams from ECR ion sources has had significant impact not only on the upgrading of cyclotron and synchrotron facilities, but also on multicharged ion collision research, as evidenced by the increasing number of ECR source facilities used at least on a part time basis for atomic physics research. In this paper one such facility, located at the ORNL ECR source, and dedicated full time to the study of multicharged ion collisions, is described. Examples of applications of ECR ion source beams are given, based on multicharged ion collision physics studies performed at Oak Ridge over the last few years. 21 refs., 18 figs., 2 tabs.

12926 (DOE/ER/13521—T1) **Correlated processes in atomic collisions: Progress report.** Feagin, J.M. (California State Univ., Fullerton (USA). Dept. of Physics). 1987. Contract FG03-86ER13521. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003508/JAW.

This paper discusses works done at California State University in the following areas: highly correlated two-electron states and transfer and excitation collisions. 8 refs. (LSP)

12927 (GSI—87-41(prepr.)) **Influence of strong magnetic fields on positron production in heavy-ion collisions.** Rumrich, K.; Greiner, W.; Soff, G. (Frankfurt Univ., Germany, F.R.. Inst. fuer Theoretische Physik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Jul 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751919/JAW.

The strongest magnetic fields (vertical strokeB vectorvertical stroke/sub max/ ≅ 10/sup 15/G) being accessible to experimental investigations are created transiently in collisions of very heavy ions. The possible interplay of these collisional magnetic fields with detected peak structures in spectra of emitted electron-positron pairs is elucidated. Relativistic two-centre continuum states for non-axial symmetric vector potentials are determined.

12928 (GSI—87-51-Prepr.) **Recent considerations of the GSI positron peaks.** Soff, G.; Reinhardt, J.; Reus, J. de; Ionescu, D.; Schramm, S.; Mueller, B.; Greiner, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Aug 1987. 19p. (CONF-8706232—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751280/JAW.

From International symposium on modern developments in nuclear physics; Novosibirsk, USSR (27 Jun 1987).

In this report we examine various attempts to explain the GSI positron peaks. After the presentation of recent experimental data we briefly sketch theoretical investigations concerning the new particle hypothesis. The failure of standard models employing a linear coupling led to more exotic scenarios for particle production. One exciting recent idea is outlined. After that we treat the possible formation of a resonance in ordinary Bhabha scattering which could represent a time-reversed channel to the observations in heavy-ion collisions. Finally we discuss the poly-positronium model and a purely atomic physics model to interprete the GSI positron events. (orig./HSI).

12929 (INIS-mf—11089, pp 84) **Study of pulsed discharges by signals.** Purdie, P.H. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

12930 (INIS-mf—11089, pp 85) **Boundary regions of a Townsend discharge.** Kelly, L.J. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

12931 (INIS-SU—431, pp 571) **Orientation effects during relativistic positronium transmission through crystals.** Kunashenko, Yu.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12932 (INIS-SU—431, pp 595) **Positronium atom in semiconductor disorded regions.** Prokop'ev, E.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12933 (INIS-SU—431, pp 548-549) **Measuring the K-shell ionization cross sections for some element atoms by protons.** Levenets, V.V.; Severin, N.F.; Shchur, A.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

12934 (JINR-E—4-86-684) **Collective spectral properties of Raman scattering.** Bogolyubov, N.N. Jr.; Shumovskij, A.S.; Tran Quang. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701145/JAW.

Submitted to the journal Phyɔ. A.

The theory of collective Raman scattering has been developed by using the quantum-mechanical master-equation approach and secular approximation. The influence of the frequency detuning of resonance and other parameters on the collective spectral properties of scattered light is investigated. 26 refs.; 3 figs.

12935 (JINR-E—4-86-700) **Induced toroid structures and toroid polarizabiilities.** Costescu, A.; Radescu, E.E. (Bucharest Univ., Romania; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Theoretical Physics). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701146/JAW.

The frequency-dependent toroid dipole polarizability $\gamma(\omega)$ of a (nonrelativistic, spinless) hydrogen-like atom in its ground state is calculated analytically in terms of two Gauss hypergeometric functions. The static result reads simply $\gamma(\omega=0)=(23/60)\alpha$/sup 2/Z/sup -4/a/sub 0//sup 5/ (α - fine structure constant, Z - nucleus charge number, a/sub 0/ - Bohr radius). Comparing the present evaluations for H-like atoms with previous ones for pions, one sees that the role of the induced toroid moments (as against that of the usual electric ones) increases considerably when passing from atomic to particle physics. 16 refs.

12936 **(KIYI—86-5) Charge exchange of neutral particles on multiply-charged ions.** Lazur, V.Yu.; Mashika, Yu.Yu. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1986. 29p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701198/JAW.

A quasi-stationary spectrum of hydrogen atom was obtained by method of etalon equations in a field of multicharged ion. The imaginary part of energy is directly related to the probability of subbarrier electron transition. A generalization was carried out on case of random atoms and molecules. The cross-sections of charge exchange processes are calculated within the range of decay model, and which agree well with experimental data. 27 refs.; 5 figs.; 2 tabs.

12937 **(LBL—24070) High resolution krypton M/sub 4,5/ x-ray emission spectra.** Perera, R.C.C.; Hettrick, M.C.; Lindle, D.W. (Lawrence Berkeley Lab., CA (USA); National Bureau of Standards, Washington, DC (USA)). Oct 1987. Contract AC03-76SF00098. 9p. (CONF-8709135—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002764/JAW.

From 14. international conference on X-ray and inner-shell processes; Paris, France (14 Sep 1987).

High resolution M/sub 4,5/ (3d → 4p) x-ray emission spectra from a krypton plasma were measured using a recently developed grazing-incidence reflection-grating monochromator/spectrometer with very high flux rates at extreme ultraviolet and soft x-ray wave lengths. The nominal resolving power of the instrument, E/ΔE, is about 300 in this energy range (~80 eV). Three dipole-allowed 3d → 4p emission lines were observed at 80.98 eV, 80.35 eV and 79.73 eV. A broad peak at about 82.3 eV is tentatively assigned to transitions resulting from Kr^{2+}, and effects of excitation energy on M/sub 4,5/ x-ray emission were observed. 9 refs., 3 figs., 1 tab.

12938 **(LBL—24071) Sub-threshold excited Cl Kβ (K-V) x-ray fluorescence from CF_3Cl molecule.** Perera, R.C.C.; Cowan, P.L.; Lindle, D.W.; LaVilla, R.E. (Lawrence Berkeley Lab., CA (USA); National Bureau of Standards, Washington, DC (USA)). Oct 1987. Contract AC03-76SF00098. 9p. (CONF-8709135—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002763/JAW.

From 14. international conference on X-ray and inner-shell processes; Paris, France (14 Sep 1987).

With the availability of tunable synchrotron radiation sources, unoccupied molecular orbits (below vacuum level) can be selectively populated producing highly excited neutral molecules. X-ray fluorescence spectra from molecules were obtained with excitation below the ionization threshold and were observed to have significant intensity changes, absolute and relative energy position shifts and line width changes as compared to fluorescence spectra excited above the threshold. As an example, the Cl Kβ (K-V) emission spectra from CF_3Cl vapor are presented. The energy shifts and intensity changes are explained in terms of perturbation effects due to the presence of an electron in an unoccupied molecular orbital. The narrow line widths obtained in the spectra excited below threshold are explained in terms of the "effective" hole production region in a core state limited by the broadening of the unoccupied level. The change in line widths as a function of below-threshold excitation energy is proposed as a novel technique to study the localized properties and reorganization effects of a hole in a core level. 10 refs., 4 figs., 1 tab.

12939 **(PSD—87, pp J6) Low energy positrons in atomic physics.** Sinapius, G. (Bielefeld Univ., Germany, F.R. Fakultaet fuer Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

12940 **(PSD—87, pp L4) Dependence of ortho-positronium pick-off annihilation lifetime on free volume in water-cyclohexylamine mixtures, and positronium bubble formation.** Jerie, K. (Wroclaw Univ., Poland). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

12941 **Effect of hybridization on 4d→4f spectra in light lanthanides.** Lynch, D.W.; Cowan, R.D. (Department of Physics and Ames Laboratory, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **36**: No. 17, 9228-9233(15 Dec 1987). Contract W-7405-ENG-82.

The effect of the hybridization of 4f electrons on La, Ce, and Pr tripositive ions with ligand states or conduction electrons was simulated by reducing the Slater integrals involving the 4f electrons by 10% or 20%, depending on whether the integrand involves one or two 4f electrons, respectively. The dipole-allowed 4d→4f spectra were calculated. Observable effects, changes in line energies, and oscillator strengths, were compared with limited data available for ionic and metallic solids containing these lanthanides, and for Ce vapor. Many of the observed changes in the 4d→4f spectra attributed to hybridization effects are found qualitatively in the calculation.

12942 **Strong correlation and alignment near the Be 1s photoionization threshold.** Krause, M.O.; Caldwell, C.D. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **59**: No. 24, 2736-2739(14 Dec 1987). Contract AC05-84OR21400.

Photoionization in atomic beryllium has been studied in detail near the 1s threshold. Multiple excitation to the 1s(2s2p /sup 1,3/P) states, i.e., conjugate shakeup, is found to be unusually strong, 40% of single excitation. The ^3P component rapidly loses strength with increasing photon energy, while the ^1P component persists. The 1s2s2p states are highly aligned, as shown by the Auger-electron angular distribution. The A_2 value of -0.65 implies a d-wave contribution of 0.39. Our results indicate that resonances reported for the solid-state photoabsorption are of atomic origin.

12943 **Search for spontaneous conversion of muonium to antimuonium.** Ni, B.; Arnold, K.; Chmely, F.; Hughes, V.W.; Kettell, S.H.; Kuang, Y.; Markey, J.; Matthias, B.E.; Orth, H.; Schaefer, H.R. (Yale University, New Haven, Connecticut 06511). *Physical Review Letters;* **59**: No. 24, 2716-2719(14 Dec 1987).

The results of an experimental search with a new method for the spontaneous conversion of muonium to antimuonium are reported. The upper limit for G/sub M//sub M-bar/, the coupling constant characterizing the strength of the interaction leading to the conversion, is measured to be G/sub M//sub M-bar/ $<$ 7.5G/sub F/ (90% confidence level), where G/sub F/ is the Fermi coupling constant. This result is about a factor of 3 lower than the previous limit and begins to probe predictions of the left-right-symmetric theory with a doubly charged Higgs triplet.

12944 **Large-angle Rayleigh scattering of linearly polarized, hard synchrotron x rays by krypton and xenon.** Smend, F.; Schaupp, D.; Czerwinski, H.; Schumacher, M.; Millhouse, A.H.; Kissel, L. (II. Physikalisches Institut der Universitaet Goettingen, D-3400 Goettingen, Federal Republic of Germany). *Physical Review [Section] A: General Physics;* **36**: No. 11, 5189-5199(1 Dec 1987).

Using linearly polarized synchrotron x rays with energies E = 21.2—43.7 keV, differential cross sections for large-angle elastic photon scattering by Kr and Xe were measured. In the case of Xe, the energy region close to the K-shell binding energy (B/sub K/ = 34.561 keV) was investigated in detail. The experimental results agree well with theoretical predictions based upon the numerical energy-shifted second-order S-matrix theory, and with high-energy-limit-corrected anomalous-scattering-factor predictions.

12945 **Quantum electrodynamics effects in the 4s-4p transitions in Cu-like and Zn-like ions.** Cheng, K.; Wagner, R.A. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **36**: No. 11, 5435-5438(1 Dec 1987). Contract W-7405-ENG-48.

Multiconfiguration Dirac-Fock energies are compared with experiment for the 4s-4p transitions in Cu-like ions and the $4s^2\ {}^1S_0$—$4s4p\ {}^1P_1$ transition in Zn-like ions for Au, Pb, Bi, Th, and U. The Coulomb, Breit, and QED contributions to these transitions are tabulated for selected ions in the range Z = 50—92. Results show that the agreement between theory and experiment is good enough to show the importance of QED corrections in the spectra of these highly stripped ions. Contrary to earlier findings by Seely et al. [Phys. Rev. Lett. 57, 2924 (1986)] we find no significant differences between the observed and calculated transition energies after finite-nuclear-size corrections are included.

12946 **Muon-helium sticking probability in the fusion reaction $(dd\mu)^+ \rightarrow \mu^3He + n$.** Hu, C.; Kauffmann, S.K. (Department of Physics, California State University, Long Beach, California 90840). *Physical Review [Section] A: General Physics;* 36: No. 11, 5420-5421(1 Dec 1987).

A variational calculation for the $(dd\mu)^+$ muon molecular ion has been carried out. Muon-helium sticking probabilities are obtained for the (J = 1, ν = 0) and (J = 1, ν = 1) states. Despite the very different method used for the three-body wave-function calculation, the present sticking probabilities agree within 2.5% with a previous calculation which uses the adiabatic representation three-body wave function.

12947 **Convergence of the Born and Coulomb-Born approximations for the electron-impact excitation of positive ions.** Younger, S.M. (A Division, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review [Section] A: General Physics;* 36: No. 11, 5432-5434(1 Dec 1987).

The convergence of the Born and Coulomb-Born approximations for the electron-impact excitation cross sections of positive ions was examined both formally and by sample calculations on several lithiumlike ions. It was found that the convergence of the two approximations with increasing energy is not necessarily monotonic and may not occur until many tens of threshold units. An analytic expansion of the Coulomb partial waves, in terms of spherical Bessel functions, indicates that partial-wave collision strengths in the two approximations do not necessarily converge in the limit of high angular momentum, although agreement at high incident energies occurs for all partial cross sections. Criteria for the use of the Born approximation for highly ionized atoms are discussed.

12948 **Observation of asymmetric Stark profiles from plasmas created by a picosecond KrF laser.** Nam, C.H.; Tighe, W.; Suckewer, S.; Seely, J.F.; Feldman, U.; Woltz, L.A. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08544). *Physical Review Letters;* 59: No. 21, 2427-2430(23 Nov 1987).

High-resolution extreme-ultraviolet spectra from solid targets irradiated by a picosecond KrF laser focused to 10/sup 16/ W/cm^2 have been recorded. The line profiles of transitions in Li-like fluorine and oxygen are asymmetric and up to 2 A in width. Calculations indicate the presence of transitions of the type 2p-3p and other forbidden Stark components.

12949 **Ground states of Ca^- and Sc^- from two theoretical points of view.** Fischer, C.F.; Lagowski, J.B.; Vosko, S.H. (Department of Computer Science, Vanderbilt University, Nashville, Tennessee 37235). *Physical Review Letters;* 59: No. 20, 2263-2266(16 Nov 1987).

Multiconfiguration Hartree-Fock theory and density-functional theory both show that the negative ions Ca^- and Sc^- have stable ground states, the extra electron being a 4p electron. The multiconfiguration Hartree-Fock method, with a relativistic shift correction, predicts an electron affinity of 0.045 eV for Ca, a result in excellent agreement with recent experiment. A less accurate calculation for Sc yields an electron affinity of 0.152 eV. Density-functional theory gives a simple explanation of why the extra electron goes into the 4p orbital rather than a 3d orbital.

12950 **Evidence for a stable negative ion of calcium.** Pegg, D.J.; Thompson, J.S.; Compton, R.N.; Alton, G.D. (Department of Physics, The University of Tennessee, Knoxville, Tennessee 37996). *Physical Review Letters;* 59: No. 20, 2267-2270(16 Nov 1987).

We present experimental evidence for the existence of a stable Ca^- ion formed in the bound $(4s^24p)\ {}^2P$ state. This result represents the first report of a stable negative ion for a group-IIA element. The structure of Ca^- was determined by means of photoelectron detachment spectroscopy. The electron affinity of Ca was measured to be 0.43 +- 0.007 eV, which is in good agreement with a recent calculation.

12951 **Oxygen K-edge extended x-ray-absorption fine-structure studies of molecules containing oxygen and carbon atoms.** Yang, B.X.; Kirz, J.; Sham, T.K. (Department of Physics, State University of New York at Stony Brook, New York 11794). *Physical Review [Section] A: General Physics;* 36: No. 9, 4298-4310(1 Nov 1987).

The absorption spectra of a group of selected molecules containing O: C bonds, carbon monoxide, carbon dioxide, carbonyl sulfide, acetone, ethanol, diethylether, tetrahydrofuran, and dioxane, have been recorded in a transmission mode in the energy region from 500 to 1000 eV. Earlier observation of extended x-ray-absorption fine structure (EXAFS) in some of these molecules is confirmed. A systematic analysis of the EXAFS spectra is performed. The results in both phase and amplitude show disagreement with the single-electron single-scattering theory with plane-wave approximation. The measured phase is systematically lower than the theory of Teo and Lee [J. Am. Chem. Soc. 101, 2815 (1979)] by about 0.7—1.5 rad, which may be significant in determining interatomic distances. The EXAFS amplitude function in the molecules containing oxygen-carbon single bonds also shows an appreciable deviation (decrease) in the first-neighbor backscattering from that predicted by theory and an increase in the second-neighbor backscattering at high-k values.

12952 **Three-photon excitation of autoionizing states of atomic krypton between the $^2P^0$/sub 3/2/ and $^2P^0$/sub 1/2/ fine-structure thresholds.** Dehmer, J.L.; Pratt, S.T.; Dehmer, P.M. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] A: General Physics;* 36: No. 9, 4494-4497(1 Nov 1987). Contract W-31-109-ENG-38.

The nonresonant, three-photon ionization spectrum of Kr between the $Kr^+\ {}^2P^0$/sub 3/2/ and $^2P^0$/sub 1/2/ fine-structure limits is reported. Members of three Rydberg series converging to the $Kr^+\ {}^2P^0$/sub 1/2/ limit, corresponding to ($^2P^0$/sub 1/2/)nd'[1/2]equivalent$_1$, (^2P/sub 1/2/)nd'[3/2]^0/sub ,/ and ($^2P^0$/sub 1/2/)ng'[7/2]$^0_3$, are observed. A fourth allowed series, ($^2P^0$/sub 1/2/nd'[5/2]$^0_3$, is not observed. Photoelectron angular distributions are reported for the 9s', 7d', and 6g' members of the observed series. Comparison of the present results with analogous measurements in Xe indicate that transitions to J = 3 final states are significantly weaker in Kr.

12953 **Dielectric satellite spectra of Li-like ions.** Mau Hsiung Chen; Crasemann, B. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Atomic Data and Nuclear Data Tables;* 37: No. 3, 419-439(Nov 1987). Contract W-7405-ENG-48.

Radiative transition wavelengths and rates as well as Auger transition probabilities for the deexcitation of the $1s2s^22p$, $1s2s2p^2$, and $1s2p^3$ configurations of Be-like ions have been calculated relativistically by the multiconfiguration Dirac—Fock method. Eight ions with atomic numbers in the range $6 \leq Z \leq 26$ are considered. The transverse Breit interaction and quantum electrodynamic corrections are taken into account in the energy calculations. The transition rates are computed in intermediate coupling with configuration interaction within the same complex. Both Coulomb and generalized Breit interactions are included in the evaluation of relativistic Auger matrix elements. The dielectronic satellite intensity factors and line fluorescence yields are also calculated.

12954 **Subharmonic resonances in higher-order collision-enhanced wave mixing in a sodium-seeded flame.** Trebino, R.; Rahn, L.A. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94550). *Optics Letters;* 12: No. 11, 912-914(Nov 1987).

Using four-, six-, and eight-wave-mixing geometries, we observe subharmonic resonances in collision-enhanced spectra in a sodium-seeded hydrogen—air flame. Appearing at high intensity, these resonances occur at +- 1/2, +- 1/3, +- 1/4, and +- 1/5 times the frequency of the ground-state hyperfine splitting ω/sub hfs/. We argue that these resonances result from higher-order processes, specifically chi/sup (//sup n//sup)/, where n≧5. In particular, to describe the resonances at +- ω/sub hfs//5, at least chi/sup (13)/ is required. These high-order collision-enhanced effects are true perturbative nonlinearities and not sequential four-wave mixing processes.

12955 **Role of projectile anti K-electrons in single and double K to anti K transfer: Comparison of passive anti K-electron models and of the IFPM with data for Cl/sup 17+,16+, ≦ 14+/ + Ti.** Becker, R.L. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* 27: No. 4, 506-511(Jul 1987). (CONF-8611124—). Contract AC05-84OR21400.

From 3. international workshop on cross sections for fusion and other applications; College Station, TX, USA (6 Nov 1986).

Electron transfer between a neutral target and a projectile ion is one of the more interesting and difficult processes to calculate. Experimentally, there is no simple, yet clean, way to measure transfer from a given shell to a given shell. For the case of K to anti K transfer (the bar designating the projectile) an indirect method is common. One measures K-vacancy cross sections for projectiles with ionic charges q=Z, Z-1, and ≦(Z-2). Then with the assumption that the initial anti K electrons are inert, one infers the K/sup 1/ to anti K/sup 1/ and K/sup 2/ to anti K/sup 2/ cross sections from linear combinations of the measured cross sections. The postulate that anti K-electrons are inert is brought into doubt by noting that the probability of inverse (anti K to K) transfer is equal by time-reversal invariance to that for K to anti K transfer. An extensive set of such measurements has been reported recently by Hall et al. for the nearly symmetric, strongly interacting systems /sub 17/Cl/sup q+/ + /sub 22/Ti. We have performed coupled-channels calculations for these systems and have compared results of various forms of the independent Fermi particle model (IFPM) with and without the assumption that any initially present anti K electron is passive. The passive anti K-electron models provide only a fair approximation to the results of the full IFPM.

12956 **Charge transfer and excitation in high-energy ion-atom collisions.** Schlachter, A.S.; Berkner, K.H.; McDonald, R.J.; Stearns, J.W.; Bernstein, E.M.; Clark, M.W.; Tanis, J.A.; Graham, W.G.; McFarland, R.H.; Stockli, M.P. (Lawrence Berkeley Lab., CA, USA; Western Michigan Univ., Kalamazoo, USA. Dept. of Physics; Ulster Univ., Coleraine, UK. Physics Dept.; Missouri Univ., Rolla, USA. Dept. of Physics; Kansas State Univ., Manhattan, USA. Dept. of Physics). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* 27: No. 4, 573-578(Jul 1987). (CONF-8611124—). Contract AC03-76SF00098;AC02-83ER13116.

From 3. international workshop on cross sections for fusion and other applications; College Station, TX, USA (6 Nov 1986).

Also published as report LBL--22457; CONF-8611124--1.

Coincidence measurements of charge transfer and simultaneous projectile electron excitation provide insight into correlated two-electron processes in energetic ion-atom collisions. Projectile excitation and electron capture can occur simultaneously in a collision of a highly charged ion with a target atom; this process is called resonant transfer and excitation (RTE). The intermediate excited state which is thus formed can subsequently decay by photon emission or by Auger-electron emission. Results are shown for RTE in both the K-shell of Ca ions and the L-shell of Nb ions, for simultaneous projectile electron loss and excitation, and for the effect of RTE on electron capture.

12957 **Low LET particles in heavy ion beams.** Llacer, J.; Tobias; Almasi, J.J. (Lawrence Berkeley Lab., Berkeley, CA). pp 99 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

Heavy ion beams used in biomedical research suffer modification as they traverse matter by nuclear fragmentation. In the Bragg peak region of a Ne beam (Z=10) with a 30 cm range, for example, 21% of the original primaries have fragmented into particles with Z between 6 and 9, and at least 70% of the particles have charge of 5 or less. Previous measurements have suffered from a lack of dynamic range in our instrumentation; the LET ratio expected with ions up to Z=14 (silicon) is approximately 2500:1, but conventional electronics work well with ratios of only 200:1. In order to be able to detect fast protons and alpha particles in the presence of nearly stopping heavy ions, the authors developed high dynamic range event discriminators. They extended the range of their experiments down to 0.25 keV/micron for ions up to Z=14 and to 2.6 keV/micron for ions between 14 and 20. The new results show large numbers of low LET particles in beams that have traversed small amounts of absorbers and very high low-LET particle fractions near the Bragg peak. The effect of these particles is to reduce the beam track average LET very strongly, but they reduce slightly the beam dose average LET.

12958 **High energy heavy ion beams used in biology and medicine: Measurement of particle distributions in the fragmentation tail.** Wong, M.; Schimmerling, W.; Rapkin, M.; Howard, J. (Lawrence Berkeley Lab., Berkeley, CA). pp 99 of Thirty-third annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1985). (CONF-8505113—).

From 33. annual scientific meeting of the Radiation Research Society; Los Angeles, CA, USA (5 May 1985).

It is well known that when a beam of high energy heavy ions passes through matter, the beam fragmentation products penetrate more deeply than the original ions. A consequence of this is that, in heavy ion radiotherapy, vital organs located behind and in close proximity to the tumor volume to be treated receive a significant fraction of the absorbed dose. Therefore, it is important to measure the absorbed dose in the tail portion of the Bragg curve, which is solely composed of fragment contributions. They have performed an experiment at Lawrence Berkeley Laboratory's Bevalac Bio-Medical facility with a 670A MeV /sup 20/Ne extracted beam. Fragments emerging from a water absorber of sufficient thickness to stop the beam were detected in a spectrometer made up of a coaxial array of solid state detectors. Particle identification was achieved through correlated measurements of time-of-flight versus energy deposition in the detectors. From the fluence and LET measurements, after correcting for spectrometer acceptance, the dose contribution for each fragment species is determined.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 11774

12959 **(AD-A—184985/0/XAB) Evolution of mean square magnetic vector potential in compressible, two-dimensional, magnetofluid turbulence.** Memorandum report. Dahlburg, R.B. (Naval Research Lab., Washington, DC (USA)). 8 Sep 1987. 11p. (NRL-MR—6012). NTIS, PC A03/MF A01.

The mean square magnetic vector potential is not invariant in ideal, two-dimensional, compressible, magnetohydrodynamic turbulence. A new, related invariant for the compressible case is given. The results are demonstrated by numerical simulation. In the compressible case large-amplitude fluctuations in the mean square magnetic-vector potential are observed.

12960 **(CONF-871196—1) One-dimensional leakage-flow vibration instabilities.** Mulcahy, T.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 58p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE88002875/JAW.

From International symposium on flow-induced vibration and noise; Chicago, IL, USA (28 Nov 1987).

Simple boundary conditions, pressure losses, and channel geometries necessary for the unstable, rigid-body translational vibrations of the wall of a one-dimensional leakage flow channel are identified. General expressions for the flow damping and stiffness forces acting on the vibrating channel wall are derived and specific results are given for channels with wall friction, point pressure losses, sharp-edged constrictions, and diverging or converging widths. The minimum conditions necessary for dynamic and static (divergence) instability were found to be an upstream point pressure loss and a diverging channel width with a finite length throat region, respectively. 7 refs., 2 tabs.

12961 **(IPPT-IFTR—12/1984) Asymptotic solutions of the MHD equations with finited conductivity.** Laprus, W. (Polska Akademia Nauk, Warsaw. Inst. Podstawowych Problemow Techniki). 1984. 17p. (In Polish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701364/JAW.

Asymptotic solutions of MHD equations for high conductivity with the accuracy to second order terms relative to 1/p, where p is electric conductivity of medium, are given. (L.I.).

12962 **(JINR-R—8-87-33) Peculiarities of non-stationary heat transfer to superfluid helium.** Miklyaev, V.M.; Sergeev, I.A.; Fillipov, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701174/JAW.

Submitted to the journal Inzh.-Fiz. Zh. .

The experimental results of investigation of heat transfer from cylindrical sample into volume of superfluid helium under step power input conditions are presented. In comparison with HeI the HeII peculiarities are enlisted and discussed: comparatively short time of stationary heat transfer rate establishment and comparatively long time of crisis reaching. Under certain conditions the qualitatively new data are obtained: the region of transitions, which include the peaks of heat transfer surface superheating and the following crisis rapid reaching. The mechanism of processes registered is discussed: superfluid turbulence, the phase transitions He II -> He I, He I -> vapour He as well, the interaction between the produced He I phase and He II volume. 12 refs.; 3 figs.; 1 tab.

12963 (N—88-10709, pp vp) **Equilibrium and tearing stability of thin current layers in magnetic arcades.** Hassam, A.B. Sep 1987. NTIS, PC A04/MF A01. (NASA-CR—181201; NAS—1.26:181201; CONF-8705245—).

From STIP symposium on physical interpretation of solar/interplanetary and cometary intervals; Huntsville, AL, USA (12 May 1987).

The MHD equilibrium of a thin, force-free current layer in a magnetic arcade is solved analytically. Various approximations are made in order to achieve a lowest order description that is physically relevant as well as mathematically tractable: The arcade is assumed to emanate from feet that are well localized, the current emanates from a localized sheet within the feet and is relatively weak. The resulting expressions for B (sup arrow) are relatively simple and natural flux coordinates are identifiable. The stability of such a current sheet to resistive filamentation is then investigated.

12964 **(PB—88-113709/XAB) Some performance comparisons for a fluid-dynamics code.** Lozier, D.W.; Rehm, R.G. (National Bureau of Standards, Washington, DC (USA). Center for Applied Mathematics). Sep 1987. 20p. (NBSIR—87/3638). NTIS, PC A03/MF A01.

The 3D transient motion of a buoyancy-driven perfect gas in an enclosure is computed by a Fortran program (BF3D). A combustion model for eventual inclusion in the program is under development. BF3D changes slowly, has a long lifetime, and is run fairly infrequently. Typical runs have large storage and moderate CPU requirements. BF3D runs on large supercomputers, but the newer mini-supercomputers appear to be suitable also and may be advantageous for ease of access and usage. Scientific workstations are convenient for development. Comparisons of BF3D on selected supercomputers, mini-supercomputers, scientific workstations and conventional mainframes are presented for the purpose of making partial benchmark data available to the computing public.

12965 **(UCID—21260) A guide to the transient three phase porous flow model implemented in the two-dimensional CRAY-TENSOR code: Physics, numerics, and code description.** Kansa, E.J. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003709/JAW.

This report deals with shocks in porous solid material. It will be understood that a shock in porous solid material refers to a propagating discontinuity with a pressure jump over a very small rise time. This report is divided into three sections: a review of the physics and the assumptions contained therein, a review of the relevant numerics necessary to obtain stable numerical solutions for the three phase governing equations, and an outline of the code structure which has been implemented in the CRAY-TENSOR code. 22 refs., 15 figs.

12966 **(UCID—21266) Mass conservation for instantaneous sources in FEM3 simulations of material dispersion.** Rodean, H.C. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004065/JAW.

This report presents the results of a systematic study in which it is shown that the numerical integration errors in determining material mass content are negligible; the material phase-change model by itself is not a cause of material mass variation; and a linear relation between fractional mass change and fractional density change at the source center for given mesh and source geometries exists over a range of values from 10^{-8} to 10^{-1}. This suggests that the omission of the ∂ rho/∂t term from the mass conservation equation is the cause of the observed non-conservation of mass by FEM3. It is shown that these mass variations can be minimized by minimizing the initial density gradients in the source region. 5 refs., 18 figs., 4 tabs.

12967 **Feasibility of numerical tracking of material lines and surfaces in chaotic flows.** Franjione, J.G.; Ottino, J.M. (Department of Chemical Engineering, University of Massachusetts, Amherst, Massachusetts 01003). *Physics of Fluids;* **30**: No. 12, 3641-3643(Dec 1987).

The evolution of material lines and surfaces is important in mixing involving fast reactions between fluids. It is shown that direct numerical tracking of the interface presents formidable computational problems in even the simplest chaotic flows because of storage requirements. The results indicate the need for a building block approach for the analysis of mixing problems involving chaotic flows.

12968 **Comment on "Generation of superfluid turbulence deduced from simple dynamical rules".** Buttke, T.F. (Department of Math and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **59**: No. 18, 2117-2117(2 Nov 1987). Contract AC03-76SF00098.

A Comment on the Letter by K. W. Schwarz, Phys. Rev. Lett. 49, 283 (1982).

12969 **Universal scaling and transient behavior of temporal modes near a Hopf bifurcation: Theory and experiment.** Deissler, R.J.; Ecke, R.E.; Haucke, H. (Center for Nonlinear Studies, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **36**: No. 9, 4390-4401(1 Nov 1987).

A forward Hopf bifurcation is characterized by the continuous development of a periodic oscillatory state from a time-inde-

pendent state as some control parameter is varied. In Rayleigh-Benard convection the control parameter is the Rayleigh number and the transition is from a stationary convective roll structure to periodic time-dependent convection. We show analytically that close to the bifurcation point the amplitudes of the temporal modes of the oscillatory state scale as (R-R$_0$)/sup n/2/, where n is the mode number. Complex-amplitude equations are also derived which give the transient behavior of these modes. Experimental data on Rayleigh-Benard convection in a dilute solution of ^{3}He in superfluid ^{4}He agree well with the theory.

12970 **Driven, dissipative superfluids: Radial counterflow of rotating ^{4}He.** Campbell, L.J. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *B: Condensed Matter;* **36**: No. 13, 6773-6781(1 Nov 1987).

Predicting the behavior of simple two-dimensional, laminar, steady-state flow in the presence of superfluid vorticity requires extension of the two-fluid model by an additional equation for the total superfluid vorticity and by the vortex nucleation rates at the boundary. For the case of superfluid ^{4}He in a rotating annulus driven by radial counterflow, predictions are made for the dissipation, meniscus profile, heat torque, angular momentum, and positive and negative vortex densities. The sensitivity of the results to vortex nucleation rates, which are currently unknown, invites their experimental measurement.

12971 **Experiences and results multitasking a hydrodynamics code on global and local memory machines.** Mandell, D. (Computational Physics Group, Applied Theoretical Physics Div., Los Alamos National Lab., Los Alamos, NM 87545). pp 415-420 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

A one-dimensional, time-dependent Lagrangian hydrodynamics code using a Godunov solution method has been multimasked for the Cray X-MP/48, the Intel iPSC hypercube, the Alliant FX series and the IBM RP3 computers. Actual multitasking results have been obtained for the Cray, Intel and Alliant computers and simulated results were obtained for the Cray and RP3 machines. The differences in the methods required to multitask on each of the machines is discussed. Results are presented for a sample problem involving a shock wave moving down a channel. Comparisons are made between theoretical speedups, predicted by Amdahl's law, and the actual speedups obtained. The problems of debugging on the different machines are also described.

12972 **Class renormalization: Islands around islands.** Meiss, J.D. (Institute for Fusion Studies, Univ. of Texas, Austin, TX 78712). pp 28-51 of Statistical plasma physics: Proceedings of Workshop of US-Japan joint institute for fusion theory program. Nagoya, Japan; Institute of Plasma Physics (1986). (CONF-8602116—).

From US/Japan workshop on statistical plasma physics; Nagoya, Japan (17 Feb 1986).

An orbit of "class" is one that rotates about a periodic orbit of one lower class with definite frequency. This contrasts to the "level" of a periodic orbit which is the number of elements in its continued fraction expansion. Level renormalization is conventionally used to study the structure of quasi-periodic orbits. The scaling structure of periodic orbits encircling other periodic orbits in area preserving maps is discussed here. Fixed points corresponding to the accumulation of p/q bifurcations are found and scaling exponents determined. Fixed points for q>2 correspond to self-similar islands around islands. Frequencies of the island boundary circles at the fixed points are obtained. Importance of this scaling for the motion of particles in stochastic regions is emphasized.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 13856

12973 **(CERN—87-07-Vol.2) Workshop on physics at future accelerators. Proceedings.** (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Jun 1987. 570p. (CONF-870180—). NTIS (US Sales Only), PC A24/MF A01. Order Number DE88700785/JAW.

From Workshop on physics at future accelerators; La Thuile, Italy (7 Jan 1987).

A workshop took place at La Thuile and at CERN in January 1987 to study the physics potential of three types of particle collider with energies in the TeV region, together with the feasibility of experiments with them. The machines were: a large hadron collider (LHC) placed in the LEP tunnel at CERN, with a total proton-proton centre-of-mass energy of about 16 TeV; an electron-proton collider, using the LHC and LEP, with a centre-of-mass energy in the range 1.3 TeV to 1.8 TeV; and an electron-positron linear collider with centre-of-mass energy about 2 TeV. The summary talks given at CERN by the conveners of the study groups are contained in volume I of the proceedings; the present volume is devoted to the contributions from the participants at La Thuile. These give details of the studies carried out on the new phenomena which might be observed at the new machines and the technical feasibility of possible experiments.

12974 **Cosmic ray heavy-ion interactions: Recent JACEE results.** Burnett, T.H.; Dake, S.; Fuki, M.; Gregory, J.C.; Hayashi, T.; Holynski, R.; Iwai, J.; Jones, W.V.; Jurak, A.; Lord, J.J. (Department of Physics, University of Washington, Seattle, USA). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 723-734(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Cosmic ray data from the JACEE experiments are reviewed for the study of high energy heavy-ion interactions. Characteristics of nucleus-nucleus collision events are summarized with regard to: [1] multiplicity and pseudo-rapidity density; [2] transverse momentum; [3] high multiplicity events; [4] correlation of high <P/sub T/ > and high multiplicity/energy density; and [5] rapidity fluctuations and pair correlation. Data seem to suggest varieties of new characteristics in the hadronic multiparticle production, some of which are not readily reducible to the simple superposition models of nucleon-nucleon collisions.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 13089, 13091, 13146, 13162, 13163, 13163, 13173, 13272, 13300, 13426, 13469

12975 **(ANL-HEP-CP—86-30) Λ production in e^+e^- annihilations at 29 GeV.** Abachi, S.; Baringer, P.; Beltrami, I.; Bylsma, B.G.; DeBonte, R.; Koltick, D.; Loeffler, F.J.; Low, E.H.; McIlwain, R.L.; Miller, D.H. (Purdue Univ., Lafayette, IN (USA); Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Michigan Univ., Ann Arbor (USA); Lawrence Berkeley Lab., CA (USA)). May 1986. Contract W-31109-ENG-38;AC02-76ER01112;AC03-76SF00098;AC02-76ER01428;AC02-84ER40125. 22p. (IUHEE—82; UM-HE—86-08; CONF-8707145—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002984/JAW.

From 33. international conference on high energy physics; Berkeley, CA, USA (16 Jul 1987).

This paper presents measurements of the inclusive production cross sections of Λ baryons in e^+e^- annihilations at $\sqrt{s} = 29$ GeV. The data sample corresponds to an integrated luminosity of 256 pb^{-1} collected with the High Resolution Spectrometer at PEP. Comparisons are made to the predictions of the Lund model. The data are well described using a strange diquark suppression parameter, (us/ud)/(s/d), of 0.89 +- 0.10/sub -0.16//sup +0.56/, and the

measured Λ/sub c/ → Λ + X branching ratio of 23 +- 10%. No polarization is observed in the Λ decays. 17 refs., 5 figs.

12976 (ANL-HEP-CP—87-43) Experimental limits on massive neutrinos from e^+e^- annihilations at 29 GeV. Errede, D.; Thun, R.; Abachi, S.; Akerlof, C.; Baringer, P.; Blockus, D.; Brabson, B.; Brom, J.M.; Bylsma, B.G.; Chapman, J. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Lawrence Berkeley Lab., CA (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA)). 1987. Contract W-31109-ENG-38. 17p. (CONF-870797—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002917/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

A search was made with the High Resolution Spectrometer at PEP for events with an isolated pair of charged tracks $e^{+-}X^{-+}$ where X is a muon or meson. Such pairs are a possible signature for the decay of massive neutrinos. Only one event was found, for a integrated luminosity of 300 pb^{-1}, satisfying certain selection criteria and with a mass m/sub ex/ > 1.8 GeV. This result places strong constraints on the existence of new neutrinos with masses from 1.8 to 6.7 GeV and with mixing parameters to the known neutrinos in the range 10^{-6} < absolute value of U^2 < 1. 12 refs., 6 figs.

12977 (ANL-HEP-CP—87-59) Measurement of the inclusive K/sub S/^{0} branching fraction in tau decay. Tschirhart, R.; Abachi, S.; Akerlof, C.; Baringer, P.; Blockus, D.; Brabson, B.; Brom, J.M.; Bylsma, B.G.; Chapman, J.; Cork, B. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Lawrence Berkeley Lab., CA (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA)). 1987. Contract W-31109-ENG-38. 12p. (CONF-870797—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002915/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

A data sample corresponding to an integrated luminosity of 300 pb^{-1} of e^+e^- annihilations at 29 GeV was used to measure the inclusive branching fraction tau$^-$ → K/sub S/^{0}X$^-$ nu/sub tau/. The experiment was performed using the High Resolution Spectrometer at the PEP storage ring. The measured branching fraction is (0.64 +- 0.15)%. The data are consistent with all K/sub S/^{0} coming from the Cabibbo-suppressed decay tau → K*$^-$(890)nu/sub tau/ leading to a branching ratio of (1.9 +- 0.28 +- 0.25)% for this channel. The inclusive sample was used to set 90% CL limits on the branching fractions of tau$^-$ → rho$^-$(1600)nu/sub tau/ and tau$^-$ → K*$^-$(1430)nu/sub tau/ of 8.5%, and 0.3% respectively. 18 refs., 3 figs.

12978 (ANL-HEP-CP—87-60) Production of eta mesons in e^+e^- annihilations at $\sqrt{s}$ = 29 GeV. Abachi, S.; Akerlof, C.; Baringer, P.; Blockus, D.; Brabson, B.; Brom, J.M.; Bylsma, B.G.; Chapman, J.; Cork, B.; DeBonte, R. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA); Lawrence Berkeley Lab., CA (USA)). 15 Jun 1987. Contract W-31109-ENG-38. 11p. (IUHEE—87-8; UM-HE—87-15; PU—87-599; CONF-870797—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002919/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

Data from e^+e^- annihilations at 29 GeV have been used to measure the production and fragmentation of eta mesons. The signal is observed in the eta → γγ decay channel. The fragmentation function for p/sub eta/ > 1.5 GeV/c agrees well with the shapes predicted by both the Lund and Webber models. However, the mean multiplicity is measured to be < n/sub eta/ > = 0.37 +- 0.08 eta mesons per hadronic annihilation event, which is significantly lower than the values predicted by either model. 6 refs., 2 figs., 1 tab.

12979 (ANL-HEP-CP—87-61) Search for D/sup */^{0} → $D^+\pi^-$. Abachi, S.; Akerlof, C.; Baringer, P.; Blockus, D.; Brabson, B.; Brom, J.M.; Bylsma, B.G.; Chapman, J.; Cork, B.; DeBonte, R. (Argonne National Lab., IL (USA); Indiana Univ., Bloomington (USA); Michigan Univ., Ann Arbor (USA); Purdue Univ., Lafayette, IN (USA); Lawrence Berkeley Lab., CA (USA)). 1987. Contract W-31109-ENG-38. 9p. (CONF-870797—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002914/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

We report on a search for the decay mode D/sup */^{0}(2007) → $D^+\pi^-$ using the High Resolution Spectrometer at PEP. Although this decay is kinematically forbidden for the central mass value, it can occur through the natural width of the D/sup */^{0}. The D^+ was reconstructed in the $K^-\pi^+\pi^+$ decay mode. The mass difference distribution $(K^-\pi^+\pi^+\pi^+) - (K^-\pi^+\pi^-)$, which shows no threshold enhancement, leads to a preliminary upper limit on the branching ratio of B/sub r/(D/sup */^{0} → $D^+\pi^-$) < 15% at 90% CL. This, in turn, corresponds to an upper limit on the D/sup */^{0} width of 1.5 MeV/c^2 at 90% CL. 4 refs., 3 figs.

12980 (ANL-HEP-CP—87-82) NN elastic scattering experiments with polarized beams. Shima, T. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 13p. (CONF-870413—17). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003108/JAW.

From 11. international conference on particles and nuclei; Kyoto, Japan (20 Apr 1987).

We report updated analysis results on an np elastic experiment at LAMPF and a pp experiment at the ZGS. We have measured two np spin asymmetry parameters, C/sub LL/ and C/sub SL/, at beam energies 500, 650, and 800 MeV. The cm scattering angles of neutrons measured ranged from 80^0 through 180^0. We observed very large C/sub LL/ at backward angles for the first time. The pp experiment at the ZGS was a measurement of the difference between the pp total cross sections for parallel and antiparallel longitudinal spin states at beam momenta 2.75, 2.92, 3.25, 3.75, and 4.00 GeV/c. These results reveal possible new structures in this momentum range. Masses for these structures are about 2700 and 2900 MeV.

12981 (BONN-IR—86-34) Diffractive particle production in proton-antiproton interactions at c.m. energies of 900 and 200 GeV. Schmickler, H.J. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Dec 1986. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751266/JAW.

In this thesis results on the inelastic particle production especially in simple diffractive processes in panti p interactions at 200 and 900 GeV c.m. energy are shown. The results are based on data which were recorded by the streamer chamber detector of the UA5 collaboration at the CERN pulsed collider in March 1985. (orig./HSI).

12982 (BONN-IR—87-07) Production of the final state K/sub S//sup 0/K/sup +-/π/sup -+/ in photon-photon reactions. Mertens, V. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Mar 1987. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88751267/JAW.

This thesis report on the observation of the two photon reaction e/sup +/e/sup -/ -> e/sup +/'e/sup -/'γ/sup */γ/sup */ -> e/sup +/'e/sup -/'K/sub S//sup 0/K/sup +-/π/sup -+/ and a search for the excitation of the charmomium state eta/sub c/(2980). The data were taken with the TASSO detector at the e/sup +/e/sup -/ storage ring PETRA at an average beam energy of 16.9 GeV and correspond to an integrated luminosity of 83.3 pb/sup -1/. The detection of the scattered leptons was not required. A total of 19 events pass the selection criteria in the γγ c.m. energy range of 1.6 - 4.4 GeV. From those events the cross section σ(γγ -> K/sup 0/K/sup +/π/sup -/(K/sup 0/K/sup -/π/sup +/) was calculated for the first time. No indication for the excitation of the eta/sub c/

(2980) was found. Thus, an upper limit on the product of the radiative width of the eta/sub c/(2980) and the branching ratio into the K/sub S//sup 0/K/sup +-/π/sup -+/ final state of Γ/sub γγ/(eta/sub c/(2980)).BR(eta/sub c/(2980)) -> K/sub S//sup 0/K/sup +-/π/sup -+/) < 1.2 keV (95% C.L.) was derived.

12983 **(CEA-N—2532) Analysis of the production of W and Z bosons in the UA1 experiment.** Stubenbrauch, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Aug 1987. 231p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number TI88751873/JAW.

Since the discovery in 1983 of the intermediate vector bosons W and Z, the number of events has considerably increased so that the first time one can study their properties precisely. A selection procedure for W -> eν and Z -> e+e- events, taking into account several quality criteria in a common CHI/sup 2/, gives final samples of 294 W -> eν events and 31 Z -> e+e- events. With these two samples, it is then possible to study the production and decay properties of the intermediate vector bosons in terms of cross sections, and Standard Model parameters as well as angular W/Z decay distribution of charged leptons. Measuring the R = σ/sub W//σ/sub Z/ ratio yields an upper limit to the number of light neutrino species. The W longitudinal and transverse momentum distribution have been analysed in detail and confirm QCD predictions. Moreover, the vector character of the gluon, necessary in QCD, can be shown directly in large momentum W events. In conclusion, the experimental distributions of the W -> eν and Z -> e+e- events confirm the Standard Model Predictions (electroweak and QCD) at Q/sup 2/ = M/sup 2//sub W/.

12984 **(CIEMAT—595) Data acquisition systems for high energy physics experiments.** Duran, I.; Olmos, P. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1986. 53p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701250/JAW.

The Data Acquisition Systems most frequently used in High Energy Physics experiments is described. This report begins with a brief description of the main elements of a typical signal processing chain, following with a detailed exposition of the four most popular instrumentation standards used in this kind of experiments: NIM, CAMAC, and VMI. (author). 20 figs., 9 ref.

12985 **(CONF-870632—8) W and Z candidates observed in the 1987 CDF run.** Holloway, L. (Illinois Univ., Urbana (USA). Loomis Lab. of Physics). 1987. Contract AC02-76ER01195. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002713/JAW.

From International Europhysics conference on high energy physics; Uppsala, Sweden (25 Jun 1987).

This is a report on W and Z candidate events seen in the data taken by CDF in the 1987 run at the Tevatron Collider at Fermilab. These results are preliminary in that acceptances have not been properly calculated and backgrounds have not been appropriately determined. Data corresponding to an integrated luminosity of 35 mg^{-1} were collected during the run. Peak luminosities were of the order of 1 x 10^{30} cm^{-2} sec^{-1}. There is some 20% uncertainty in the value of the luminosity, given the current understanding of the luminosity monitoring system. 4 figs.

12986 **(DESY—87-009) Results from PETRA. A review of results from the five PETRA experiments during the past year.** Barlow, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.); Manchester Univ. (UK)). Feb 1987. 48p. (CONF-8608205—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751268/JAW.

From SLAC summer institute topical conference; Stanford, CA, USA (6 Aug 1986).

The author reviews the experiments at PETRA during 1986. Especially he considers the measurement of electroweak asymmetries, lifetime measurements with the TASSO vertex detector, charm production in two-photon collisions, QCD studies, and inclusive muon and heavy quark fragmentation. (HSI).

12987 **(DOE/ER/40193—1) Investigation of hadronic matter at the Fermilab Tevatron Collider: Technical progress report, 1986 October-1987 October.** Anderson, E.W. (Iowa State Univ. of Science and Technology, Ames (USA)). 1 Nov 1987. Contract AC02-85ER40193. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003140/JAW.

An investigation of hadronic matter at very high energy densities is reported. The present experiment, E-735, is a search for a deconfined quark-gluon plasma phase of matter expected to occur when temperatures of 240 MeV are achieved. Preliminary data have been obtained during the first operation of the Fermilab Tevatron Collider during the period January to May 1987. The collaboration is about to publish first results on the charged particle multiplicity and transverse momentum distributions. In addition, we have data on the particle identification of the produced secondaries. Both measurements are regarded on theoretical grounds to be sensitive indicators of the formation of a high temperature plasma. The capital project funded under this contract was a 240-element trigger hodoscope array, with associated electronics and monitor. The hodoscope was completed and performed to design expectations in the high-rate and high-radiation environment of the Collider. Scientific personnel supported under this contract were also responsible for the implementation of the data acquisition system used for E-735. Although the system underwent several unanticipated modifications in response to changing schedules, the required service was provided. Preparations are currently under way for the principal data acquisition during the spring of 1988. At that time we will have in place the central tracking chamber, and the remainder of the spectrometer chambers. Tests will also be made on backgrounds and detector materials appropriate to our proposal, P-787, to measure leptons and photons in the third Collider running period.

12988 **(DOE/ER/71019—T1) A research program in neutrino physics, cosmic rays and elementary particles: Progress report, January-December 1987.** Reines, F.; Chen, H.H.; Doe, P.J.; Gajewski, W.; Hahn, A.A.; Kropp, W.R.; Moe, M.K.; Newman, R.D.; Price, L.; Sobel, H.W. (California Univ., Irvine (USA). Dept. of Physics). Aug 1987. Contract AT03-76ER71019. 34p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003507/JAW.

This paper reports the observation of a two-neutrino double beta decay of selenium 82 in the laboratory. It also contains short summaries on the following work: neutrino electron elastic scattering, the large Cerenkov detector, the Cygnus experiment and the Sudbury Neutrino Observatory. 2 figs. (LSP)

12989 **(EFI—889(40)-86) Correlations in photoproduction of cumulative protons.** Alanakyan, K.V.; Amaryan, M.J.; Asryan, G.A. and others. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700959/JAW.

The results of measurements of correlations between cumulative and forward protons and π-mesons produced by bremsstrahlung γ-quanta of maximum energy 4.5 GeV are presented. It is shown that such correlations exist. In (pp) coincidence the correlation is expressed through the dependence of the correlation coefficient on the angle and momentum of cumulative protons, whereas in (pπ) coincidence it depends only on the momentum of cumulative protons. A conclusion is made, according to which the spectra of cumulative protons are different in single-particle inclusive production and in production with hadrons emitted in forward direction. 8 refs.; 5 figs.

12990 **(EFI—908(59)-86) Effective method for electrons coherent bremsstrahlung polarization calculation based on intensity spectra.** Akopyan, N.N.; Galumyan, P.I.; Grabskij, V.O.; Karapetyan, V.V.; Karapetyan, G.V. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700961/JAW.

An effective method is presented for polarization calculation of electrons coherent bremmstrahlung specra in monocrystals, using fast Fourier transformation. The relative accuracy of the calculation compared with the results of conventional methods is about 2-3% in the working region of the first coherent maximum. At the same time, the method provides a high-speed calculation, which

permits it to be used for on-line processing of coherent bremsstrahlung spectra. 7 refs.; 6 figs.

12901 **(IAE—4356/2) About a possibility of experimental observation of quark-gluon plasma.** Tarasov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701292/JAW.

Investigations into observing quark-gluon plasma and its transformation into hadrons is reviewed. A brief consideration of theoretical predictions of possible manifestation of studied phenomena is presented: gain of the yield of lepton pairs and hard photons, k, λ et al. strange particles, vector mesons and antiprotons; correlations of strange particles in the range of plasma trasformation into hadrons, correlation between the value of transverse momenta and multiplicity in the speed central region; appearance of pion clusters in production of quark-gluon plasma; possibility of producing quark-gluon plasma during annihilation of protons and light antinuclei in nuclei. 32 refs.; 23 figs.

12902 **(IFVE-OEF—86-219) Study on the diffractive processes in the P-barp -> p-barp2π/sup +/2π/sup -/ exclusive channel at 32 GeV/c.** Bogolyubskij, M.Yu.; Borovikov, A.A.; Bumazhnov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 12p. (In Russian). (SERP-E—138). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701048/JAW.

For experimental data on p-barp -> p-barp2π/sup +/π/sup -/ exclusive channel the method to select double diffractive dissociation of the type (pπ/sup +/π/sup -/)/sub d/+(p-barπ/sup +/π/sup -/)/sub d/ and single diffrative dissociation of the type (pπ/sup +/π/sup -/π/sup +/π/sup -/)/sub d/+p was developed and the cross sections for these processes were estimated. It is shown that the decay of the diffractively excited protons and antiprotons into three hadrons occures mainly through the intermediate state with Δ/sup ++/ isobar but a five-particle diffractive system is produced through the intermediate state with Δ/sup ++/ and rho/sup 0/ (770). In the effective-mass pπ/sup +/π/sup +/ spectra of five-particle diffractive system a threshold maximum was observed which can be connected with Δ/sup ++/ production interference effect. 18 refs.; 7 figs.

12903 **(IFVE-ONF—86-210) Inclusive production of π/sup 0/ mesons in π/sup +/p-,K/sup +/p- and pp interactions at 250 GeV/c.** Adamus, M.A.; Azhinenko, I.V.; Atayan, M.R. and others. (Warsaw Univ., Poland; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; Erevanskij Fizicheskij Inst., USSR). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701299/JAW.

Data on inclusive π/sup 0/ production in the forward hemisphere at Feynman variable (x > 0.025) in the center-of-inertia system in π/sup +/p, K/sup +/p, and pp interactions at 250 GeV/c are presented. These data are compared to the data at lower energies and interpreted in terms of quark-parton models. 24 refs.; 8 figs.

12904 **(IFVE-ONF—86-223) Observation of μ/sup -/e/sup -/ - events in neutrino interactions at 3-30 GeV.** Ammosov, V.V.; Ermolaev, V.I.; Ivanilov, A.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 7p. (SERP-E—107). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701053/JAW.

Observation of μ/sup -/e/sup -/-events in neutrino interactions in bubble chamber SCAT exposed to the neutrino beam of the IHEP accelerator has been reported. The relative yield of μ/sup -/e/sup -/-events is (2.5/sub -1.4//sup +4.3/)x10/sup -4/ from the total number of charged current events at average neutrino energy of 10 GeV. The yield ratio μ/sup -/e/sup -//μ/sup -/e/sup +/ is equal to (0.12+0.22)-(0.12-0.08). 13 refs.; 1 fig.

12905 **(INFN-LNF—87-18-(R)) Experiment to measure the electromagnetic form factors of the neutron in the time like region at Adone.** Antonelli, A. and others. (Istituto Nazionale di Fisica Nucleare, Frascati, Italy. Lab. Nazionale di Frascati). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701063/JAW.

A physics program is presented that will be run starting in 1987 at the Adone machine in Frascati, when it will come back to e/sup +/e/sup -/-yields antineutron neutron; other channels are under consideration for new measurements or monitoring purposes. The machine developments related to the e/sup +/e/sup -/- operation are discussed and the detection apparatus, presently under construction, is described. 24 refs.

12906 **(INIS-mf—11099) Hard processes in photon-photon interactions.** Duchovni, E. (Weizmann Inst. of Science, Rehovoth (Israel)). Mar 1985. 152p. NTIS (US Sales Only), PC A08/MF A01. Order Number TI88701083/JAW.

Contains an annotated bibliography of 424 references.

In this thesis, the existence of hard component in two-photon collisions is investigated. Due to the relative simplicity of the photon, such processes can be exactly calculated in QCD. Untagged (low Q/sup 2/) two-photon events are used. This leads to relatively high statistics, but to severe background problem due mainly to e/sup +/e/sup -/annihilation. The background contamination is reduced to a tolerable level using a special set of cuts. Moreover, the remaining contamination is shown to be calculable with a small systematic error. A large number of events of the hard "γγ" type is found. An attempt to explain these events using the simplest QCD diagram (the Born term) is done. This process is found to be capable of explaining only a 1/4 of the data. Other options like the constituent intercharge model, integer charged quarks, and higher order diagrams are therefore also discussed. The large cross-section for the production of rho/sup 0/rho/sup 0/ pairs in "γγ" collisions has not been understood yet. Inorder to look at closely related processes, a search for phirho/sup 0/ and phiphi was initiated. The cross-section for θπ/sup +/π/sup -/was found to be sizeable. Only upper limits for the production of phirho/sup 0/ and phiphi are obtained.

12907 **(INP—1242/PH) Evidence for a non-qq-bar tensor meson at 1410 MeV produced in the reaction π/sup -/p->K/sub s//sup o/K/sub s//sup o/n at 63 Gev.** Daum, C.; Hertzberger, L.; Hoogland, W. and others; Amsterdam-CERN-Cracow-Muenchen-Oxford-Rutherford Collaboration. (NIKHEF-H, Amsterdam, Netherlands). (Institute of Nuclear Physics, Krakow (Poland)). 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701345/JAW.

We present an analysis of the K/sub s//sup o/K/sub s//sup o/ system produced in the reaction π/sup -/p->K/sub s//sup o/K/sub s//sup o/ at 63 GeV based on ~ 700 events in the kinematical region of chemical bondtchemical bond<0.5 GeV/sup 2/. We concentrate on masses between 1200 and 1600 MeV where a double maximum structure is observed. Performing an amplitude analysis in this mass interval we find that S, D/sub o/ and D/sub +/ waves contribute to the mass spectrum at approximately equal strength. The peaks are attributed to spin 2 waves. However, we failed to explain them by interfering f(1270), A/sub 2/(1310) and f'(1520) resonances alone. While the first peak can be associated with f(1270) -A/sub 2/(1310) production, an additional tensor meson is needed with mass of ~ 1410 MeV and a narrow width for a description of the second one. The analysis as well as the energy dependence deduced from some published K/sub s//sup o/K/sub s//sup o/ mass spectra suggests this object to be dominantly produced by a natural parity exchange. Because the 2/sup ++/qq-bar nonet is already complete the nature of the new tensor meson is an open question.

12908 **(INP—1257/PH) Is there a 2/sup ++/ glueball at 1410 MeV?.** Turnau, J. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701353/JAW.

A glueball component of the J/sup PC/ = 2/sup ++/ qq-bar isoscalar states is discussed within a simple mass mixing model.

As the third isoscalar necessarily present in the qq-bar-gg mixing scheme we assume G(1410) claimed by ACCMOR Collaboration in the π/sup -/p->K/sub s//sup o/K/sub s//sup o/n data. The hypothesis is found to be compatible with the available experimental data, including two-photon decay widths and radiative J/psi decays.

12999 **(INP—1259/PH) Observation of the scalar meson at 1260 MeV in the reaction PI/sup -/p->PI/sup +/PI/sup -/n at 17.2 GeV/c.** Rybicki, K.; Sakrejda, I.; Turnau, J. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701354/JAW.

An analysis of the reaction PI/sup -/parrow up->PI/sup +/PI/sup -/n at 17.2 GeV/c for chemical bondtchemical bond>0.2 GeV/sup 2/ yields relatively narrow scalar resonance well fitted by the Breit-Wigner formula. A fit to low and high chemical bondtchemical bond S-wave needs a new object which we call G (1260) with a width of (160+-10) MeV in addition to a broader Σ(1300) resonance. Unusual production properties of the former are tentatively explained in terms of a hybrid meson trajectory. An importance of the polarized target information is also discussed.

13000 **(INP—1261/PH) Search for unconventional mesons.** Turnau, J. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 89p. (In Polish). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701356/JAW.

Selected problems of the fixed target meson spectroscopy connected with the issue of unconventional states glueballs, hybrides and four-quarks are discussed. The experimental basis of the dissertation consists of some results of the WA3 experiment performed by ACCMOR collaboration (PI/sup -/p->(3PI)/sup -/p, K/sup -/p->K/sup -/PI/sup +/PI/sup -/p, PI/sup -/p->K/sub s//sup o/K/sub s//sup o/n) and of the S136 experiment performed by CCM collaborations (PI/sup -/parrow up->PI/sup +/PI/sup -/n, PI/sup -/parrow up->K/sup +/K/sup -/n). Mesons with spin parities J/sup PC/ = 0/sup -+/, 0/sup ++/, 1/sup ++/ and 2/sup ++/ are discussed from the point of view of the phenomenology of unconventional states.

13001 **(INP—1262/PH) Analysis of the reaction PI/sup -/p->PI/sup +/PI/sup -/n at high four-momentum transfer.** Sakrejda, I. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 86p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701357/JAW.

An analysis of PI/sup +/PI/sup -/ system produced in the reaction PI/sup -/p->PI/sup +/PI/sup -/n at high four-momentum transfer and in the mass region between 600 MeV and 1500 Mev is presented. It is based on results of the CERN-Munich collaboration at 17 GeV, the CERN-Cracow-Munich collaboration at the same energy but using a polarized C/sub 4/H/sub 9/OH target and of the ACCMOR collaboration at 63 GeV. The high statistics of 5x10/sup 4/, 1.9x10/sup 5/ and 2.8x10/sup 4/PI/sup +/PI/sup -/ pairs obtained in these three experiments allowed the first thorough study of the poorly known region of high four-momentum transfer. The main result of our analysis is an observation of a new J/sup PC/ = 2/sup ++/ meson with mass 842+-19 Mev and width 248+-49 MeV. The partial wave analysis (PWA) suggests an unnatural parity exchange as a production mechanism of this state. As the 2/sup ++/ nonet is already filled with known states, the speculation on the nature of this object is presented. Apart from the analysis of this effect, the production of rho(770), f(1270) and E(1300) for low and high four-momentum transfer is compared. (author). 36 refs.

13002 **(ITEF—5(1987)) Production of 0.6-1.62 GeV/c cumulative pions in the pA -> π/sup +-/X reaction at incident proton energy of 10.14 GeV.** Boyarinov, S.V.; Gerzon, S.A.; Kiselev, Yu.T. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701366/JAW.

Invariant cross sections in the production of cumulative π/sup +-/ mesons on Be, Al, Cu, Ta nuclei at the angle of 119 deg in laboratory system induced by 10.14 GeV protons, are measured. The production of cumulative pions has the same peculiarities as the production of cumulative pions. This proves a similar mechanism of their production. The evidence on the change in the nature of dependence of invariant cross section on the transverse momentum at the cumulative number x ~1, is obtained. 8 refs.; 11 figs.

13003 **(JINR-E—1-86-780) Differential cross sections for reactions of π/sup +/n -> K/sup +/E/sup 0/ and π/sup +/n -> K/sup +/Λ and ratio of differential cross sections of π/sup +/A -> K/sup +/Y+A' quasi-binary processes for carbon and deuterium nuclei at 10.3 GeV/c.** Bitsadze, G.S.; Budagov, Yu.A.; Dzhelepov, V.P. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701141/JAW.

Submitted to the journal Yad. Fiz. .

The results of the study of π/sup +/n -> K/sup +/Σ/sup 0/ and π/sup +/n -> K/sup +/Λ reactions at 10.3 GeB/c are presented. The measurements were carried out at missing mass spectrometer HYPERON at IHEP accelerator. The differential cross sections in 0 $\leqq$ t-t/sub min/ < 0.4 (GeV/c)/sup 2/ momentum transfer range are measured. The integral cross sections in the studied t-interval are (11.8+-1.1)μb and (21.7+-2.2)μb for reactions π/sup +/n -> K/sup +/Σ/sup 0/ and π/sup +/n -> K/sup +/Λ, respectively. The obtained results were compared with the predictions of quasi-eikonal model and with other experimental data. The ratio A/sub eff//sup (t)/ of differential cross sections for π/sup +/A -> K/sup +/Y+A' reactions on carbon and deuterium nuclei are measured. The A/sub eff//sup (t)/ tend to grow with increasing t in agreement with the predictions of QCD-based model. 8 refs.; 4 figs.; 2 tabs.

13004 **(JINR-R—1-86-710) Investigation of Compton effect on π-meson and charged pion polarizability.** Antipov, Yu.M.; Batarin, V.A.; Bezzubov, V.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701151/JAW.

The results of an experiment aimed at the study of the 40 GeV/c pion radiative scattering on nuclei at small momentum transfers are presented. Compton effect on the pion was investigated and the charged pion polarizability was measured. The pion Compton-effect cross section dependence on the incident photon energy ω'/sub 1/(rest pion frame) was measured in the 100 - 600 MeV range. The polarizability of charged pion from the analysis of Compton-effect events has been found to be β/sub π/=-α/sub π/=(-6.9 +- 1.4/sub stat./ +- 1.2 /sub syst./)x10/sup -43/ cm/sub 3/ and the sun of pion electrical α/sub π/ and magnetic β/sub π/ polarizability has been estimated to be in agreement with theoretical predictions: α/sub π/+β/sub π/ $\approx$ 0. 63 refs.; 12 figs.; 7 tabs.

13005 **(JINR-R—1-87-27) Experimental estimation to a contribution of absorption secondary processes in proton production, emitted into backward hemisphere in nucleon-carbon interactions at 4.2 and 10 GeV/c.** Armutlijski, D.; Gasparyan, A.P.; Grishin, V.G. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701154/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

On the basis of data obtained in an analysis of stereopictures from the 2-m propane bubble chamber correlations between protons emitted into the backward hemisphere in the laboratory system frame and other accompanying protons have been investigated for nucleon-carbon interactions at 4.2 GeV/c. Kinematic correlations show a considerable role of the absorption mechanism of low-energy π/sup +0/-meson production by quasi-deuteron pairs in nuclear matter. The obtained estimate of this process contributes about 30 per cent of the inclusive cross section for proton production in the backward hemisphere. 6 refs.; 3 figs.

13006 **(LA-UR—87-3724) Transverse energy distribution, charged particle multiplicities and spectra in ^{16}O-nucleus collisions.** Sunier, J.W. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 8p. (CONF-8709152—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003176/JAW.

From 18. international symposium on multiparticle dynamics; Tashkent, USSR (8 Sep 1987).

The HELIOS (High Energy Lepton and Ion Spectrometer) experiment, installed at the CERN Super Proton Synchrotron, proposes to examine in details the physical properties of a state of high energy created in nuclei by ultra-relativistic nucleus-nucleus collisions. It is generally believed that, at high densities or temperatures, a phase transition to a plasma of quark and gluons will occur. The dynamic of the expansion of such a plasma and its subsequent condensation into a hadron gas should markedly affect the composition and momentum distribution of the emerging particles and photons. The HELIOS experimental setup therefore combines 4π calorimetric coverage with measurements of inclusive particle spectra, two particle correlations, low and high mass lepton pairs and photons. The emphasis is placed on transverse energy flow (E/sub T/) measurements with good energy resolution, and the ability to trigger the acquisition of data in a variety of E/sub T/ ranges, thereby selecting the impact parameter or the violence of the collisions. This short note presents HELIOS results, for the most part still preliminary, on ^{16}O-nucleus collisions at the incident energies of 60 and 200 GeV per nucleon. The E/sub T/ distributions from Al, Ag and W targets are discussed and compared to the associated charged particle multiplicities from W. Charged particle and (converted) photon spectra measured with the external magnetic spectrometer are compared for ^{16}O + W and p + W collisions at 200 GeV per nucleon. 5 refs., 7 figs.

13007 **(LBL—24086) Jet physics at PEP and PETRA.** Hofmann, W. (Lawrence Berkeley Lab., CA (USA)). Sep 1987. Contract AC03-76SF00098. 34p. (CONF-870821—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002737/JAW.

From SLAC summer institute on particle physics; Stanford, CA, USA (10 Aug 1987).

Recent data on the fragmentation of quarks at PEP and PETRA energies is discussed in the context of phenomenological models of parton fragmentation. Emphasis is placed on the experimental evidence for parton showers as compared to a fixed order QCD treatment, on new data on inclusive hadron production and on detailed studies of baryon production in jets. 63 refs., 22 figs., 3 tabs.

13008 **(MPI-PAE/Exp.El.—183) Production of charmed hadrons in neutrino proton and antineutrino proton charged current interactions.** Jones, G.T.; Jones, R.W.L.; Geiser, A.; Klein, H.; Kuhn, D.; Morrison, D.R.O.; Oldenborgh, G.J. van; Schmid, P.; Wachsmuth, H.; Miller, D.B. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Birmingham Univ. (UK). Dept. of Physics; Imperial Coll. of Science and Technology, London (UK). Dept. of Physics; Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.); Oxford Univ. (UK). Nuclear Physics Lab.; University Coll., London (UK). Dept. of Physics). Aug 1987. 21p. Also published in Z. Phys., C (Nov 1987) v. 36(4) p. 593-601.

Using data from a νp and anti νp experiment with BEBC at CERN, the rates for inclusive production of D/sup *+/, Λ/sub c//sup +/ and D/sup 0/ in νp scattering and of D/sup *-/ in anti νp scattering are measured. Some examples of the exclusive production of D/sup *+/, Λ/sub c//sup +/ and Σ/sub c//sup ++/ are given. The cross section for the reaction νp -> μ/sup -/Σ/sub c//sup ++/ is estimated.

13009 **(NEI-NO—33) High energy elastic hadron scattering. Experiment, data and theoretical descriptions.** Fearnly, T.A. (Oslo Univ. (Norway)). Apr 1986. 290p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88751306/JAW.

Reprints of seven previously published papers.

The paper deals with the WA7 experiment at the CERN super proton synchrotron (SPS). The elastic differential cross sections of pion-proton, kaon-proton, antiproton-proton, and proton-proton at lower SPS energies over a wide range of momentum transfer were measured. Some theoretical models in the light of the experimental results are reviewed, and a comprehensive impact parameter analysis of antiproton-proton elastic scattering over a wide energy range is presented. A nucleon valence core model for high energy proton-proton and antiproton-proton elastic scattering is described.

13010 **Measurements of the Σ0/sub c/-Λ/sub c/$^+$ and Σ/sub c/$^{++}$-Λ/sub c/$^+$ mass differences.** Diesburg, M.; Ladbury, R.; Binkley, M.; Bossi, F.; Butler, J.; Coteus, P.; Cumalat, J.P.; DiCorato, M.; Enagonio, J.; Filaseta, J. (University of Colorado, Boulder, Colorado 80303). *Physical Review Letters;* **59**: No. 24, 2711-2715(14 Dec 1987).

Measurements of the Σ/sub c/^{0}-Λ/sub c/$^+$ and Σ/sub c//sup ++/-Λ/sub c/$^+$ mass differences have been made in a beam of incident neutrons. Our Σ/sub c//sup ++/-Λ/sub c/$^+$ mass-difference measurement is 167.4 +- 2.1 MeV/c^2, in good agreement with previous results. We measure the Σ/sub c/^{0}-Λ/sub c/$^+$ mass difference to be 178.2 +- 2.0 MeV/c$_2$. We use these measurements to determine the Σ/sub c//sup ++/-Σ/sub c/^{0} mass splitting to be -10.8 +- 2.9 MeV/c^2.

13011 **Exclusive production of proton-antiproton pairs in two-photon collisions.** Aihara, H.; Alston-Garnjost, N.M.; Avery, A.R.E.; Barbaro-Galtieri, A.A.; Barker, A.A.R.; Barnett, A.B.A.; Bauer, J.D.A.; Bengtsson, G.H.; Bintinger, D.D.L.; Bobbink, F.G.J. (Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 11, 3506-3509(1 Dec 1987).

We report cross sections for the process $\gamma\gamma \to$pp-bar at center-of-mass energies W from 2.0 to 2.8 GeV. These results have been extracted from measurements of $e^+e^- \to e^+e^-$pp-bar at an overall center-of-mass energy of 29 GeV, using the TPC/Two-Gamma facility at the SLAC storage ring PEP. Cross sections for the untagged mode [both photons nearly real] are shown to lie well above QCD predictions. Results are also presented for the single-tagged mode [one photon in the range $0.16 < Q^2 < 1.6$ (GeV/c)^2].

13012 **High-energy diffraction dissociation of K/sub L/^{0} into exclusive final states.** Lamm, M.J.; Wiss, J.E.; Avery, P.; Butler, J.; Gladding, G.; Goodman, M.C.; O'Halloran, T.; Russell, J.J.; Wattenberg, A.; Busenitz, J. (University of Illinois, Urbana, Illinois 61801). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 11, 3341-3352(1 Dec 1987).

We have observed diffraction dissociation of K/sub L/^{0} mesons with a carbon target into the exclusive final states K/sub S/$^0\pi^+\pi^-$, K/sub S/$^0\omega$, and K/sub S/^{0}phi. The diffraction production cross section for these states is not strongly dependent on the incident energy, varying at most by 30% between 75 and 150 GeV. The mass distributions do not change appreciably as a function of laboratory energy. The ratio of the diffractive mass-threshold production of K/sup *//sup +- /π/sup minus-or-plus/, K/sub S/^{0}rho, K/sub S/$^0\omega$, and K/sub S/^{0}phi is compared with previously obtained lower-energy data.

13013 **Search for free quarks produced by 14.5-GeV/nucleon oxygen ions.** Shaw, G.L.; Matis, H.S.; Pugh, H.G.; Slansky, R.; Alba, G.P.; Bland, R.W.; Dickson, S.C.; Hodges, C.L.; Johnson, R.T.; Lindgren, M.A. (Physics Department, University of California, Irvine, California 92717). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 11, 3533-3536(1 Dec 1987).

A high-sensitivity experiment was carried out to detect free quarks produced in collisions of 14.5-GeV/nucleon oxygen nuclei with a heavy target at BNL. Secondaries from the collisions were stopped in liquid-argon tanks, and charged atoms were collected electrostatically on gold-coated electrodes. The gold coatings were dissolved in a small drop of mercury, which was then tested for quarks in the San Francisco State University automated Millikan apparatus. No evidence for free fractional charge was found. The resulting upper limit is less than 1.0 x 10/sup -9/ quarks produced per incident /sup 16/O ion at 90% C.L.

13014 **Observation of Ωp production in e^+e^- annihilation at 29 GeV.** Klein, S.R.; Himel, T.; Abrams, G.; Amidei, D.; Baden, A.R.; Barklow, T.; Boyarski, A.M.; Boyer, J.; Burchat, P.R.; Burke, D.L. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review Letters;* 59: No. 21, 2412-2415(23 Nov 1987). Contract AC03-76SF00515.

Inclusive Ω^- production in e^+e^- annihilation at 29 GeV has been measured with the Mark II detector. From an integrated luminosity of 207 pb/sup -1/, we determine a production rate of 0.014 +- 0.006 +- 0.004 Ω^-,Omega-bar$^+$ per hadronic event. This is roughly 35 times the Lund-model prediction of 0.0004 Ω^-,Omega-bar$^+$ per hadronic event, but comparable to the Webber-model prediction of 0.006 Ω^-,Omega-bar$^+$ per hadronic event. The large rate of Ω^- production, compared with production rates for other baryons, and with theoretical predictions based on diquark models, indicates that spin suppression does not hold for Ω^- production.

13015 **Observation of spin-1 $f_1(1285)$ in the reaction $\gamma\gamma^* \rightarrow eta^0\pi^+\pi^-$.** Gidal, G.; Boyer, J.; Butler, F.; Cords, D.; Abrams, G.S.; Amidei, D.; Baden, A.R.; Barklow, T.; Boyarski, A.M.; Burchat, P. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). *Physical Review Letters;* 59: No. 18, 2012-2015(2 Nov 1987). Contract AC03-76SF00098.

We observe both the J/sup P//sup C/ = 1^{++} $f_1(1285)$ and the J/sup P//sup C/ = 0^{-+} eta'(958) in tagged two-photon interactions and the eta'(958) in untagged interactions. The measured Q^2 dependence and decay distribution support the $f_1(1285)$ spin and parity assignment. The radiative width of the $f_1(1285)$ is measured as $(M^2/Q^2)\Gamma$/sub $\gamma\gamma$/sub $\gamma\gamma$/sub */ = 9.4 +- 2.5 +- 1.7 keV, on the assumption of a rho-pole form factor.

13016 **Evidence for a spin-1 resonance in the reaction $\gamma\gamma^* \rightarrow K^0K$/sup +- /$\pi$/sup +- /.** Gidal, G.; Boyer, J.; Butler, F.; Cords, D.; Abrams, G.S.; Amidei, D.; Baden, A.R.; Barklow, T.; Boyarski, A.M.; Burchat, P. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). *Physical Review Letters;* 59: No. 18, 2016-2019(2 Nov 1987). Contract AC03-76SF00098.

We confirm the observation of a spin-1 resonance at 1423 MeV in the K/sub S/^{0}K/sup +- /π/sup minus-or-plus/ system produced in single-tagged two-photon interactions. The Dalitz plot indicates that this resonance decays primarily via a K/sup */K intermediate state. We measure a radiative width times branching ratio B/sub K//sub K-bar//sub π/$(M^2/Q^2)\Gamma$/sub $\gamma\gamma$/sub $\gamma\gamma$/sub */ = 3.2 +- 1.4 +- 0.6 keV on the assumption of a rho-pole form factor.

13017 **Production of eta and ω mesons in tau decay and a search for second-class currents.** Baringer, P.; McIlwain, R.L.; Miller, D.H.; Shibata, E.I.; Behrends, S.; Guida, J.M.; Guida, J.A.; Morrow, F.; Poling, R.; Thorndike, E.H. (Purdue University, West Lafayette, Indiana 47907). *Physical Review Letters;* 59: No. 18, 1993-1996(2 Nov 1987).

The production of eta and ω mesons in tau decay has been studied with the CLEO detector. A sample of 42 000 $e^+e^- \rightarrow tau^+tau^-$ events at a mean $\sqrt{s}$ of 10.5 GeV is used in the analysis. The branching ratio B(tau$^-\rightarrow\omega\pi^-\nu$/sub tau/) is measured to be (1.60 +- 0.27 +- 0.41)%. No signal for eta production from tau decay is observed, resulting in 95%-confidence-level upper limits of 1.8% for B(tau$^-\rightarrow$eta$\pi^-\nu$/sub tau/), 2.1% for B(tau$^-\rightarrow$eta$\pi^-\pi^0\nu$/sub tau/), and 2.1% for inclusive eta production in tau decay. No evidence is found for decays proceeding via second-class currents.

13018 **Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders.** Cox, B.; Fenner, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). 473p. (CONF-8511150—). Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510-5000.

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

These proceedings address issues in triggering, data acquisition, and off-line computing for high energy/high luminosity hadron-hadron colliders, including physics signatures; analog triggers; data filtering/acquisition and processing; networking; and special spectrometers and instrumentation.

13019 **Total cross sections and elastic scattering at the SSC.** Foley, K.J. (Brookhaven National Lab., Upton, NY 11973). pp 409-414 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—). Contract AC02-76CH00016.

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

An important special purpose detector is needed for the measurement of elastic scattering at the SSC. The total cross sections and elastic scattering cross sections are very basic quantities that should be measured at every new energy regime - for example, a measurement of the real part of the scattering amplitude provides a "Crystal-Ball" to even higher energies via the forward dispersion relations. Since the appropriate intersection region is very different from the standard the author feels that it requires careful attention as the machine design proceeds. In principle one needs to know the luminosity very well, but a combination of the two above measurements in the same apparatus at the same time can be used to eliminate the need for absolute luminosity measurements although one must still assume spin independence. This technique has been used recently at the CERN p-barp collider.

13020 **Los Alamos crystal box experiment: A search for $\mu \rightarrow e\gamma$, $\mu \rightarrow e\gamma\gamma$, and $\mu \rightarrow eee$.** Hallin, A.L.; Bolton, R.; Bowman, J.D.; Carlini, R.; Cooper, M.; Duong-van, M.; Frank, J.S.; Heusi, P.; Hoffman, C.M.; Hogan, G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* 123: No. 1, 477-483(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A search has been performed for the decays $\mu \rightarrow eee$, $\mu \rightarrow e\gamma$, and $\mu \rightarrow e\gamma\gamma$ with a sensitivity in the branching ratios at the level of 10/sup -10/. The experiment used a surface muon beam at LAMPF with an average intensity of 300 kHz. A total of $>10^{11}$ muon decays was examined for the present result. The detector for the experiment is the Crystal Box which consists of a cylindrical drift chamber surrounded by 396 NaI(Tl) crystals. A layer of scintillation counters in front of the crystals provided timing for electrons and a veto for photons. The energy resolution for electrons and photons is ~6% (FWHM). The position resolution of the drift chamber is 350 μm leading to a vertex cut with a rejection of 10^3 for $\mu \rightarrow eee$. The timing resolution is ~400 ps from the scintillators and ~1 ns from the crystals. From these values, the eee and $e\gamma\gamma$ limits are expected to be background free.

13021 **Possible higher precision measurement of the muon G-2 value.** Hughes, V.W.; Danby, G.T. (Yale University, Physics Department, New Haven, CT 06511). *AIP (American Institute of Physics) Conference Proceedings;* 123: No. 1, 534-537(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The theoretical motivation for and a possible experimental approach to higher precision measurement of the muon g-2 value are discussed. The goal is to measure $a = (g-2)/2$ to a precision of 0.3 ppm, which would be an improvement by a factor of 20 over the present value from a CERN experiment. The approach would involve a superconducting muon storage ring and would utilize the very high primary proton beam intensity now available at the Brookhaven National Laboratory AGS.

13022 **YALE-BNL search for K°/sub L/→μe and K°/sub L/→ee.** Schmidt, M.P. (Yale University, New Haven, Connecticut). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 952-960(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A status report is presented for the Brookhaven AGS experiment E780, a search for the flavor changing neutral currents K°/sub L/→μe and K°/sub L/→ee to 10^{-10} in branching ratio sensitivity.

13023 **Solar neutrino spectroscopy.** Haxton, W.C. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1026-1036(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The nuclear physics, particle physics, and astrophysics motivations for completing a program of solar neutrino spectroscopy are reviewed.

13024 **Report on solar neutrino experiments.** Davis, R. Jr.; Cleveland, B.T.; Rowley, J.K. (Brookhaven National Laboratory, Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1037-1050(15 Nov 1984). (CONF-8405193—). Contract AC02-76CH00016.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A summary is given of the status of solar neutrino research that includes results of the Brookhaven chlorine detector, a discussion of the development of the gallium, bromine, and lithium radiochemical detectors. The gallium and bromine radiochemical detectors are developed and are capable of giving critical information of interest about neutrino physics and the fusion reactions in the interior of the sun. A plan for building these detectors is outlined and a rough cost estimate is given. A review is given of the plans in the Soviet Union in solar neutrino research.

13025 **Kaon decay - Can CP violation be observed with charged kaons?.** Souder, P.A. (Syracuse University, Syracuse, New York, 13210). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 888-894(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Comparing the decays $K^+ \to \pi^+\pi^+\pi^-$ and $K^- \to \pi^-\pi^-\pi^+$ is a possible way to study CP violation that was exploited in an experiment published in 1970. The merits of performing an improved experiment are evaluated in light of recent theoretial developments and available experimental technology.

13026 **Nucleon-nucleon scattering to 800 MeV.** Spinka, H. (Argonne National Laboratory, Argonne, Illinois 60439). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1065-1071(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Recent data on spin dependent total cross sections and elastic scattering spin observables measured at the meson factories are summarized. Model independent amplitude determinations and phase shift analyses of these data are discussed. The importance of these results for the existence of dibaryons is mentioned.

13027 **Analyzing power measurements in high-P²/sub parallel/ p-p elastic scattering.** Raymond, R.S.; Brown, K.A.; Bruni, R.J.; Cameron, P.R.; Crabb, D.G.; Cummings, R.L.; Khiari, F.Z.; Krisch, A.D.; Lin, A.M.T.; Terwilliger, K.M. (Randall Laboratory of Physics, The University of Michigan, Ann Arbor, Michigan 48109). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1123-1125(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The analyzing power in 28 GeV/c proton/proton elastic scattering was measured at P²/sub parallel/ = 5.95 and 6.56 (GeV/c)² using a polarized proton target and an unpolarized proton beam at the Brookhaven National Laboratory AGS. Results indicate that the analyzing power, A, is rising sharply with P²/sub parallel/.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 12223, 12882, 12998, 13000, 13001, 13023, 13025, 13114, 13120, 13133, 13135, 13145, 13162, 13399, 13461, 13462, 13463, 13466

13028 **(ANL-HEP-CP—87-87) Characteristics of multimuon events from fourth generation quarks at the SSC [superconducting super collider].** Baer, H. (Argonne National Lab., IL (USA)). 14 Aug 1987. Contract W-31109-ENG-38. 7p. (CONF-870739—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002954/JAW.

From Workshop on experiments, detectors, and experimental areas for the supercollider; Berkeley, CA, USA (7 Jul 1987).

Multimuon events can be a distinctive signature for pair production of t-quarks or 4th generation quarks at the SSC. In this paper we address aspects of the multimuon event topology relevant to detector design for the SSC. In particular, we discuss energy measurement, rapidity range, segmentation and the need for hadronic calorimetry in a dedicated muon detector.

13029 **(DOE/ER/40325—03) Status of the electroweak theory.** Sirlin, A. (Rockefeller Univ., New York (USA). Dept. of Physics). 1987. Contract AC02-87ER40325. 22p. (RU—87/B1/15; CONF-870797—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002342/JAW.

From International symposium on lepton and photon interactions at high energies; Hamburg, F.R. Germany (27 Jul 1987).

The status of the electroweak theory is discussed. Particular emphasis is placed on the quantum corrections, constrains on new physics and recent developments concerning the KMC matrix, B^0 - anti B^0 oscillations, CP violation, neutral currents, vector boson masses and solar neutrinos. 44 refs., 4 figs., 3 tabs.

13030 **(EFI—911(62)-86) Polarization effects in H/sup 0/-boson production in pp-bar and pp collisions.** Grigoryan, S.G.; Chatrchyan, S.A. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700963/JAW.

The polarization effects in associated with fermion pairs production of Higgs scalar particles in pp-bar and pp-collisions are studied. These effects are shown to be great, therefore their measurement may appear an important additional tool to separate from the background processes that are essential practically for all mechanisms of Higgs boson production. 17 refs.

13031 **(EFI—913(64)-86) Inclusive spectra of hadron resonances in the framework of multiparton recombination model: 2. Pion and kaon fragmentation.** Badalyan, N.N.; Badalyan, R.G.; Gulkanyan, G.R. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88700964/JAW.

Inclusive spectra of "direct" fragmentation of pion and kaon into meson and baryon resonances are obtained in the framework of multiparton recombination model. The parameters of distribution of sea partons in pion and kaon are estimated from the comparison of model predictions with the experimental data. Satisfactorily are described the inclusive spectra of meson rho/sup 0/, phi, K/sup +-,0/(890), K/sup +-,0/(1430) and antibaryon Σ-bar/sup +-/(1385) resonances in a wide range over the Feynman variable x, and also baryon resonances Σ/sup +-/(1385), Δ/sup ++/(1232) at $x>0.4$ in the fragmentation region of pion and kaon in πP- and KP-interactions at high energies. 28 refs.; 10 figs.

13032 **(EFI—923(74)-86) On quark-gluon systems fragmentation functions.** Badalyan, R.G. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88700965/JAW.

A statistical approach to the question of "soft" fragmentation of quark-gluonic system S to hadron h is considered. Expressions for the fragmentation function D/sub s//sup h/ (x) (where x is the Feynman variable) of the process S -> h are obtained. The quark-to-hadron fragmentation functions are in particular defined. A comparison of the prediction for the considered statistical approach with experimental data is carried out with respect to π/sup +//π/sup -/ (π/sup -//π/sup +/)-mesons yields in deep-inelastic scattering of neutrino (antineutrino) on the nucleon. 23 refs.; 3 figs.

13033 **(EFI—939(90)-86) Some peculiarities of conjoined hadroproduction of standard Higgs boson and heavy quark pair.** Bagdasaryan, A.S.; Egoryan, R.Sh.; Grigoryan, S.G.; Matinyan, S.G. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700975/JAW.

A contribution to total cross section of conjoined hadroproduction of the H/sub 0/-boson and the heavy quark pair Q and Q-bar (Q=c, b, t,...) from the H/sub 0/-boson "gluonic" production diagrams (the so-called GGH-diagrams) is being discussed. A comparison is carried out between contributions to total cross sections from the GGH-diagrams and the H/sub 0/-boson "direct" quark production diagrams (QH-diagrams). It is shown that with increasing M/sub H/ the enhancement effect of the GGH contribution "enters the game". 6 refs.; 6 figs.

13034 **(EFI—942(93)-86) Spin excitations of mesons in QCD sum rule.** Grigoryan, A.A.; Tyugu, A.Eh. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700977/JAW.

Non-local gauge-invariant quark currents are considered as hadron sources in the framework of the QCD sum rules for analysis of properties of meson excitations. There the contribution of a "bare" quark loop and gluon correction to the current correlator for random spin states are calculated. It is shown that in the mass range on Regge trajectories, there takes place a quark-hadron duality - the power correction contribution connected with the gluon condensate, is small with respect to that of the perturbation theory. The obtained formulae correctly describe the masses of resonances on Regge trajectories rho, ω, A/sub 2/, f. 5 refs.

13035 **(EFI—950(101)-86) Calculation of QCD triangular Feynman graphs in external gluonic field using the Reduce-2 system.** Dulyan, L.S. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700980/JAW.

Methods and ways applied in the calculation of the QCD triangular Feynman diagrams with the use of the REDUCE-2 system are described. The encountered difficulties connected with the specific features of the REDUCE-2 system are discussed. 5 refs.; 1 fig.

13036 **(IAE—4353/2) Deep inelastic scattering and parton potentials.** Kuznetsov, G.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701291/JAW.

Lorentz group representation formalism is applied for studying deep-inelastic lepton-hadron scattering, that is decisive in determining hadronic structure. 4 refs.

13037 **(IFVE-ONF—86-131) Prospects for discovery of supersymmetry at the UNK collider.** Laparteliani, A.G.; Sokolov, A.A.; Volkov, G.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701052/JAW.

Future direct production on pp and pp-bar-colliders of the supersymmetric partners of the ordinary particles predicted by the modern supersymmetry models: supergravity and superstring models, has been discussed. The problem what maximum masses of the superpartners in the spectrum predicted by the superstring models are available for the UNK study has been investigated. In particular, it is shown that the problem of the gluino detection on the pp-bar collider (3 TeVx3 TeV) with the luminosity L/sub pp-bar/=10/sup 34/ cm /sup -2/ s/sup -1/ may be fully solved (up to m/sub g-tilde/ ~ 400 GeV), but for the scalar quarks - partially (attainable m/sub q-tilde/ ~ 500 GeV). The following UNK stage pp (3 TeVx3 TeV) L/sub pp/=10/sup 32/ cm/sup -2/ s/sup -1/ will allow to cover almost the whole expected interval including the scalar quark (m/sub q-tilde/ <or approx. 800 GeV). The upper limits of the masses Z/sub E/ and W/sub R//sup +/ gauge bosons predicted by the modern string theories and available for the UNK investigation are presented. 19 refs.; 7 figs.; 3 tabs.

13038 **(IFVE-OTF—86-204) Quantum technicolour model with composite gauge bosons.** Novozhilov, Yu.V. (Leningradskij Gosudarstvennyj Univ., USSR). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701054/JAW.

A quantum technicolour model is presented where the Higgs particle, gauge bosons and new vector and scalar particles are obtained by chiral, conformal and vector bosonization of techniquark degrees of freedom. All masses are expressed in terms of the technigluon condensate with M/sub Higgs/=(4/3)m/sub W/ and the Weinberg angle is fixed at 30 deg. 13 refs.

13039 **(IFVE-OTF—86-231) Spin effects at UNK.** Troshin, S.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701058/JAW.

State of experimental and theoretical investigations of spin effects at high energies at storage accelerator complxes (SAC) is briefly reviewed in order to obtain new data on hadron structure and mechanism of particle interaction. Problems of elastic scattering with low transfered momenta are considered taking polarization study in π/sup -/p -> π/sup 0/n reaction and the mechanism of total cross-section growth with energy increase as examples. Elastic hadron scattering in the region of large angles where the mechanism of quark and gluon interaction and hadron composite structure are manifested plainly is discussed. Experimental data obtained when studying these interactions testify to pronounced dependence of the dynamics of hadron component interaction on their spin freedom degrees. Various quark models, considering nonzero polarization in processes of large angle scattering are studied briefly. Inelastic binary reactions at fixed transfered momenta which are of great interest for studying interaction of valent quarks are discussed. Concrete proposals for the programs of experimental investigations of spin effectat SAC for all considered interactions are given. 15 refs.

13040 **(IFVE-OTF—86-234) On one estimate of glueball mass.** Boos, E.E. (Moskovskij Gosudarstvennyj Univ., USSR. Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701059/JAW.

The Bethe-Salpeter equation for the wave function of the bound state of two gluons is considered. The mass of the glueball 0/sup ++/, (M/sub gl/ ~ 1.3 GeV), is estimated using some expansions in the equation kernel in the spirit of those made in the QCD sum rules method. In the leading approximation, the masses of the glueballs 0/sup ++/ and 2/sup ++/ appear to be degenerate. A possibility to improve the accuracy of estimating the mass by using the expansion in 1/N/sub c/ is discussed. 22 refs.; 3 figs.

13041 **(IFVE-OTF—86-237) W and Z bosons as clustermeter at UNK.** Smirnov, A.Yu.; Sultanov, S.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; AN Azerbajdzhanskoj SSR, Baku. Inst. Fiziki). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701060/JAW.

It is proposed to study quark distributions in nuclei in the kinematically prohibited region with the help of subthreshold production of intermediate vector bosons. 4 refs.; 2 tabs.

13042 (INIS-mf—11100) **Standard and non-standard weak interactions.** Leurer, M. (Weizmann Inst. of Science, Rehovoth (Israel)). Dec 1985. 154p. NTIS (US Sales Only), PC A08/MF A01. Order Number TI88701084/JAW.

Contains an annonated bibliography of 71 references.

This work consists of independent chapters, all deal with weak interactions. The first chapter deals with left-right symmetric theories. Two main versions of these theories are discussed and compared. In addition, the K - K-bar mixing term is analysed: it has been known for several years now that in a left-right symmetric model there are new contributions to the mixing of kaons. We show that in the most appealing left-right symmetric model - the new contributions add up constructively. Consequently, we may derive reliable bounds on the mass of the right-handed gauge boson and the average mass of the (unavoidable) physical Higgs scalars. We also show that the new contributions are proportional to a new CP violating phase. While all previous treatments of the K - K-bar system were limited to the minimal model, we are able to show that our results hold also in the general case of nonminimal models. The second chapter deals with the possibility that W and Z are composite. Three experimental tests are discussed: (i) Universality - if W is composite then its coupling to the fermions is expected to deviate from universality. Since such deviations were not yet seen - we derive a lower bound on the compositeness scale. (ii) Possible enhancement of the reaction p-bar+p->Z/sup 0/+γ+any - we show that if Z/sup 0/ is composite then the cross section for the above process might be considerably enhanced and this effect can be measured at CERN and Fermilab.(iii) The e$\epsilon\gamma$ events of the 1983 run in CERN - we show that in contradiction to suggestions made in several papers, these events may not be explained by a composite-Z decaying through a scalar. In the last chapter we discuss the quark mixing angles.

13043 (INIS-mf—11102) **Weak radiative decays of baryons.** Safadi, R. (Technion-Israel Inst. of Tech., Haifa). Jun 1986. 193p. (In Hebrew). NTIS (US Sales Only), PC A09/MF A01. Order Number TI88701085/JAW.

Contains an annotated bibliography of 39 references.

Weak radiative decays of baryons are investigated in order to clarify the corresponding basic mechanics. Firstly the Σ/sup +/ pγ vertex which consists of two terms: the magnetic moment transition term and the charge radius term. Both terms contribute to decays in which the photon is virtual, wherease only the magnetic moment term contributes to decays in which the photon is real. Among the several mechanisms that contribute to the above terms, are the single and the two quark transitions. In this work, the ratio of these two terms is studied by investigating the decays of spin 1/2 baryons to Delitz pairs, namely, the decays of the Σ->pl/sup +/l/ sup -/type, where l = e or μ. Secondly, the sdγ vertex is investigated and the QCD corrections to the amplitude of this transition are examined. It is proved that information on sdγ vertex can be obtained by studying decays of the Ω/sup -/->γ/sup -/γ type and the Ω/sup -/->γl/sup +/l/sup -/ type, since the s->dγ mechanism is the dominant one in these dec???.

13044 (INIS-SU—431, pp 266) **On Michel parameter analogue in neutrino (antineutrino)-electron scattering.** Gnedov, Yu.A.; Romanov, Yu.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13045 (INIS-SU—431, pp 147) **Effective meson QCD Lagrangian and nuclear forces.** Andrianov, V.A.; Novozhilov, V.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13046 (INIS-SU—431, pp 148) **Chiral bag in quantum chromodynamics.** Andrianov, V.A.; Novozhilov, V.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13047 (INIS-SU—431, pp 149) **Baryon-soliton solution stability of effective meson QCD Lagrangians.** Andrianov, V.A.; Vladimirov, Yu.M.; Novozhilov, V.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13048 (INP—1239/PH) **Chromoelectric flux tubes and the transverse momentum distribution in high energy nucleus-nucleus collisions.** Bialas, A.; Czyz, W. (Uniwersytet Jagiellonski, Krakow, Poland. Inst. Fizyki). (Institute of Nuclear Physics, Krakow (Poland)). 1984. 9p. (TPJU—3/84). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701343/JAW.

Transverse momentum distribution of quark-antiquark pairs created - through tunneling - from chromoelectric flux tubes of an arbitrary field strength spanned between two arbitrary color charges is computed and its properties are discussed. It is also argued that such non-elementary flux tubes may be responsible for large P/sub perpendicular/ tails observed in nucleus-nucleus collisions at energies > or approx. 100 GeV/ nucleon. (author). 16 refs.

13049 (IPNO-TH—87-24) **Tensor and bispinor representation of massless fields.** Lukaszuk, L.; Szymanowski, L. (Szczecin Univ., Poland). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Mar 1987. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88751883/JAW.

For a general form of the massless boson field of arbitrary spin we show that Lorentz covariance completly determines the tensor field wave function; the equality of this function and the generator of little group is established. The general parametrization of potential is presented. The bispinor representation of fields is introduced and its properties are examined. As an application, several processes involving the graviton bremsstrahlung are considered and simple expressions for the helicity amplitudes are obtained.

13050 (IPNO-TH—87-49) **Witten-type interaction of strings with unequal lengths.** Knecht, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jun 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88751885/JAW.

A BRS-invariant (in 26 dimensions) three-string vertex, extending Witten's one to strings of different lengths, is constructed. The "joining-and-splitting" picture corresponds to a singular limit in the space of string-length parameters. Independence of S-matrix elements with respect to the latter is checked explicitly in the case of the on-shell tachyon-tachyon-vector amplitude.

13051 (ITEP—3(1987)) **Diffraction dissociation and elastic scattering.** Verebryusov, V.S.; Ponomarev, L.A.; Smorodinskaya, N.Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701119/JAW.

In the framework of Regge scheme with supercritical pomeron a model is suggested for the NN-scattering amplitude which takes into account the contribution introduced to the intermediate state by diffraction dissociation (DD) processes. The DD amplitude is written in terms of the Deck model which has been previously applied to describing the main DD features. The calculated NN cross sections are compared with those obtained experimentally. Theoretical predictions for higher energy are presented. 17 refs.; 10 figs.

13052 (ITEP—14(1987)) Toronic domains in QCD vacuum. Simonov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701376/JAW.

Vacuum configurations of SU(2) constant selfdual and antiselfdual fields confined to the interior of domain in the 4d Euclideon space are considered, with quantized field strength as in abelian torons. Statistical ensemble of the domain distributions ensures confinement and chiral symmetry breaking, while adjoint charges are not confined. 12 refs.; 3 figs.

13053 (ITEP—21(1987)) Unified description of ground state mesons and baryons in a potential model. Badalyan, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701121/JAW.

Ground state masses are calculated using the Cornell potential for all mesons and baryons and assuming V/sub qq/=1/2V/sub qq-bar/ quark-quark potential. A good fit of spin-spin splittings for mesons and baryons is obtained with the QCD coupling constant α/sub S/(Q/sup 2/). The resulting masses agree with the experimental ones within ~ 20 MeV for both mesons and baryons. 13 refs.

13054 (ITEP—121(1986)) Froissart type rise of cross sections and predictions for spectra and multiplicities of hadrons at future accelerators. Ter-Martirosyan, K.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701126/JAW.

Experimental data of ISR and SPS colliders on σ/sup tot/ and on the diffraction cone slope [B(s)]/sub t=0/ are used for a more precise determination of parameters (s=αp(0)-1 and others) of the supercritical Pomeron. With account of all P/sup n/ rescatterings it leads to the Froissart type rise of cross sections at high energy. The quark-gluon string model of Pomeron, describing the existing experimental data, leads to predictions for super high energies of spectra of hadrons produced with small p/sub perpendcular/, in particular, the values of (dN/sub ch//dy)/sub y=0/, hadron average multiplicities <N>=N-bar/sub ch/(ξ) and even their distributions over multiplicity W(N)=S/sub N//σ/sup in/. The results are presented as curves and tables for energies $\sqrt{s}$=0.9, 2, 4, 10, 20, 40, 10/sup 2/, 10/sup 3/ TeV. 14 refs.

13055 (ITEP—181(1986)) Standard model with additional scalar isotriplet. Gerasimov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701379/JAW.

Standard model of weak interactions with additional isotriplet of scalar bosons is considered. From the analysis of experimental data there are found restrictions on the masses of the bosons and Yukawa couplings of their interactions with leptons. Possibility of non-weak interactions with neutrinos is also considered. 9 refs.; 6 figs.

13056 (ITEP—184(1986)) MIT bag model Hamiltonian as an effective Hamiltonian of quantum chromodynamics. Krivoruchenko, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701381/JAW.

A possibility of derivation of the MIT bag model Hamiltonian from QCD is discussed. The bags are interpreted as wave packets of hadrons localized in the region x $\leq$ R where R is the bag radius. In the Fock space of gluodynamics a subspace P of the localized states is constructed and it is shown that projection of the Yang-Mills Hamiltonian into P has a representation in the Fock space P/sup V/ of a Hamiltonian H/sup V/ that depends on gluon fields defined inside a spherical cavity of radius R. The gluon fields obey boundary conditions. The one-to-one correspondence of vectors P and P/sup V/ conserves Hermitian product, matrix elements of the Yang-Mills Hamiltonian between the states P are equal to the matrix elements of H/sup V/ between the corresponding states of P/sup V/. Explicit form of the Hamiltonian H/sup V/ is found. The MIT bag model Hamiltonian approximates in rough features the Hamiltonian H/sup V/. 12 refs.

13057 (KEK—87-5) E/sup +/e/sup -/ event generator EPOCS user's manual. Version 1.1, March 18, 1987. Kato, Kiyoshi; Munehisa, Tomo. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1987. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751458/JAW.

EPOCS(Electron Positron Collision Simulator) is a Monte-Carlo event generator for high energy e/sup +/e/sup -/ annihilation. This program generates events based on the standard model, i.e., quantum chromodynamics (QCD) and electro-weak theory. It works at the center-of-mass energy below W/sup +/W/sup -/ production, i.e., in the energy region of TRISTAN, SLC and LEP. For these high energy machines one of the important subjects is the exploration for the top quark. The production and hadronization of the top quark is included in EPOCS. Besides the top quark, we expect 'new' physics in this high energy region. EPOCS has enough flexibility for users to cope with a new idea. Users can register a new particle, modify the built-in particle data, define new primary interactions and so on. The event generator has a number of parameters, both physical parameters and control parameters. Users can control most of these parameters in EPOCS at will.

13058 (LA-UR—87-3741) Summary talk at the international symposium on strangeness in hadronic matter. Garvey, G.T. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 13p. (CONF-8706212—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003171/JAW.

From International symposium on strangeness in hadronic matter; Bad Honnef, F.R. Germany (1 Jun 1987).

A selected summary of the workshop is presented. Emphasis is placed on the future role of studying kaon rare decay and an apparent solution of the $\Delta I = 1/2$ enhancement in strangeness-changing weak decays. Also discussed is a proposed kaon condensate of hadronic matter as well as recent and proposed experiments on S = -1, -2 dibaryons. The summary concludes with a brief discussion of the status of hypernucleus research. 12 refs., 4 figs., 1 tab.

13059 (LA-UR—87-3823) Normal matter storage of antiprotons. Campbell, L.J. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 18p. (CONF-8710125—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003169/JAW.

From 2. review and planning workshop on antiproton science and technology; Santa Monica, CA, USA (6 Oct 1987).

Various simple issues connected with the possible storage of anti p in relative proximity to normal matter are discussed. Although equilibrium storage looks to be impossible, condensed matter systems are sufficiently rich and controllable that nonequilibrium storage is well worth pursuing. Experiments to elucidate the anti p interactions with normal matter are suggested. 32 refs.

13060 (LAL—87-41) On the scalar quark and top quark mass limits in the case of a light stop. Grivaz, J.F. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Aug 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751886/JAW.

It is remarked that the scalar quark mass limit obtained by the UA1 experiment vanishes in the case of a single light scalar quark, most likely a scalar partner of the top. It may even be that this stop is lighter than the top itself, in which case the UA1 limit on the top mass is also affected.

13061 **(PINSTECH/NPD—115) Analysis of heavy ion elastic scattering data by s-matrix parameterization.** Qureshi, I.E. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.). Dec 1984. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701222/JAW.

It is shown that the general features of the heavy ion elastic scattering data are reproduced by using a smooth cut-off model for the scattering matrix in which the real nuclear phase shift and the reflection coefficient are used as analytic functions and have a few adjustable parameters. A computer program is described for carrying out the calculations to fit the experimental ratio of elastic differential cross-sections to Rutherford cross-sections. The scattering of 10.375 MeV/u/sup 12/C ions from Fe, Ag and Ta are considered as test cases. The absorption radii and reaction cross-section predicted by the theory are also calculated.

13062 **(RAL—87-048) What we can learn from $\gamma\gamma \to \pi\pi$, KKbar in the resonance region.** Morgan, D.; Pennington, M.R. (Rutherford Appleton Lab., Chilton, UK; Durham Univ., UK). (Rutherford Appleton Lab., Chilton (UK)). Jul 1987. 55p. (DTP—87/10). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88751643/JAW.

The two photon couplings of hadronic states are believed to be key pointers to their parton constituents. With the aim of studying these, a method is presented of analysing data on $\gamma\gamma \to \pi\pi$ (and KKbar), which embodies the constraints of unitarity and analyticity while respecting the QED low energy theorem required by gauge invariance. This analysis is applied to presently available data on $\pi\pi$ production and it is found that within the existing uncertainties few definitive conclusions can yet be drawn in the resonance region. In the near threshold region, the authors confirm the overwhelming dominance of the QED Born amplitude modified by final state interactions, in contradiction with several recent data-sets on the π^+/π^- channel. It is shown how the new Crystal Ball experiment on $\pi^0\pi^0$ production not only confirms this conclusion on the near threshold cross-section, but angular analysis of their data with its better statistics using the method the authors present should shed light on the nature of the scalar mesons in the 1 GeV region.

13063 **(RAL—87-052) Structure function analysis and psi, jet, W, Z production -pinning down the gluon.** Martin, A.D.; Stirling, W.J.; Roberts, R.G. (Durham Univ., UK. Dept. of Physics). (Rutherford Appleton Lab., Chilton (UK)). Jul 1987. 43p. (DTP—87/28). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751644/JAW.

A next-to-leading order structure function analysis of deep inelastic μN and νN scattering data is carried out, and acceptable fits for a range of input gluon distributions are found. Three equally acceptable sets of parton distributions are shown which correspond to gluon distributions which are (1) 'soft', (2) 'hard' and (3) which behave as xG(x) approx. $1/\sqrt{x}$ at small x. Set 1, with the 'soft' gluon distribution, is favoured. W, Z and jet production data from the CERN collider are well described but do not distinguish between the sets of structure functions. The precision of the predictions for W and Z cross sections allow the collider measurements to yield information on the number of light neutrinos and the mass of the top quark. Finally, how the gluon distribution at very small x may be directly measured at HERA is discussed.

13064 **(RAL—87-072) Gluonic hadrons.** Close, F.E. (Rutherford Appleton Lab., Chilton (UK)). Sep 1987. 83p. NTIS (US Sales Only), PC A05/MF A01. Order Number TI88751835/JAW.

To be published in Rep. Prog. Phys. .

The standard theory of colour forces (Quantum Chromodynamics) suggests that in addition to the familiar hadrons made of quarks, there should exist new states where coloured gluons play an essential dynamical role. The author reviews the theoretical predictions for the properties of these "glueballs" and of states containing resonating quarks and gluons. Attempts are made to highlight those features which are common to several models in the literature. Experimental candidates are confronted with the models. No clear cut signal for a gluonic hadron yet exists; consequently what future data are required to determine the constituency of some popular candidates is considered.

13065 **(RAL—87-077) String theory.** Chan Hongmo. (Rutherford Appleton Lab., Chilton (UK)). Oct 1987. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751838/JAW.

In honour of Professor Sir Rudolf Peierls on his 80th birthday symposium.

The paper traces the development of the String Theory, and was presented at Professor Sir Rudolf Peierls' 80sup(th) Birthday Symposium. The String theory is discussed with respect to the interaction of strings, the inclusion of both gauge theory and gravitation, inconsistencies in the theory, and the role of space-time. The physical principles underlying string theory are also outlined. (U.K.).

13066 **(SLAC-PUB—4435) Summary and outlook on the future.** Prescott, C.Y. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1987. Contract AC03-76SF00515. 7p. (CONF-8708174—2). NTIS, PC A02. Order Number DE88003263/JAW.

From 7. international conference on physics in collision; Tsukuba, Japan (25 Aug 1987).

Highlights of the Physics in Collision Conference are reviewed. Selected topics briefly discussed in the framework of the Standard Model are: supersymmetry, the Higgs particles, heavy quarks and leptons, and compositeness in quarks and leptons. The direction of future colliders is also discussed. 8 refs., 7 figs., 1 tab. (LSP)

13067 **Hale, Brown, and Jarmie reply.** Hale, G.M.; Brown, R.E.; Jarmie, N. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **59**: No. 24, 2819(14 Dec 1987).

A He-5 resonance is described in terms of poles on unphysical sheets. (AIP)

13068 **Neutral and charged Higgs detection. Heavy quark fusion, top quark mass-dependence and rare decays.** Gunion, J.F.; Haber, H.E.; Paige, F.E.; Tung, W.K.; Willenbrock, S.S.D. (California Univ., Davis, USA. Dept. of Physics; California Univ., Santa Cruz, USA. Dept. of Physics; Brookhaven National Lab., Upton, NY, USA; Illinois Inst. of Tech., Chicago, USA; Wisconsin Univ., Madison, USA. Dept. of Physics). *Nuclear Physics [Section] B;* **294**: No. 3, 621-635(14 Dec 1987).

We examine the relevance of heavy quark fusion processes for production of both neutral and charged Higgs bosons. Top quark mass-dependence of these mechanisms as well as of gg fusion production of the neutral Higgs is explored. We find that gg fusion is generally larger than tanti t fusion for the neutral Higgs and even dominates WW/ZZ fusion in the region m/sub H0/ $\leq$ 1 TeV for top masses above m/sub t/ = 150 GeV. For charged Higgs boson production via tb fusion, the rate may be sufficiently large to permit its detection by making use of the $H^+ \to \tau^+\nu$ decay mode; other distinctive final states, available in supersymmetric models, are also considered. Finally, we show that backgrounds to heavy quark fusion subprocesses can be reduced by tagging on a lepton emitted from the accompanying spectator t-quark.

13069 **Horizontal symmetry and the fourth generation.** Babu, K.S.; He, X. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **36**: No. 11, 3484-3493(1 Dec 1987). Contract AC02-76ER13065.

A systematic investigation of all possible horizontal symmetries acting on four generations of quarks in a minimal left-right-symmetric model is carried out. There are only two consistent models with realistic constraints on the quark masses and mixing angles. It is shown that Z_4 is the unique symmetry group leading to these models. The fourth-generation quark masses m/sub b'/sub '/ and m/sub t'/sub '/ are constrained to be (A) m/sub b'/m/sub t/

≅m/sub b//sub '//m/sub t//sub '/, (B) m/sub s//m/sub c/≅(m/sub b/+m/sub b//sub '/)/(m/sub t/+m/sub t//sub '/). Thus, model (A) predicts m/sub t/,m/sub b//sub '/≦43 GeV whereas model (B) has m/sub b//sub '/≦58 GeV. The two models differ in the mixing of the fourth generation into the first three. A crucial test which can distinguish the two models is a direct measurement of the mixing matrix element chemical bondV/sub u//sub b/chemical bond. Model (A) predicts it to be ~10/sup -4/, an order of magnitude smaller than the prediction of model (B).

13070 **Leptoquark-boson signals at e^+e^- colliders.** Hewett, J.L.; Rizzo, T.G. (Center for Particle Theory, University of Texas, Austin, Texas 78712). *Physical Review [Section] D: Particles and Fields;* **36**: No. 11, 3367-3372(1 Dec 1987).

We examine the production of scalar-leptoquark-boson (S) pairs in e^+e^- annihilation along with indirect limits of leptoquark-boson properties from existing e^+e^- data and that which can be obtained in the near future from the Stanford Linear Collider and the CERN collider LEP.

13071 **Strongly interacting singlet-doublet Higgs model.** Hill, A.; van der Bij, J.J. (University of Michigan, Department of Physics, Ann Arbor, Michigan 48109). *Physical Review [Section] D: Particles and Fields;* **36**: No. 11, 3463-3473(1 Dec 1987).

We study the effects on the vector-boson parameters due to a heavy scalar singlet interacting strongly with the Higgs sector of the standard model. The one-loop-induced effects due to the additional scalar are not suppressed by inverse powers of its mass. In the limit that the singlet-Higgs coupling becomes much larger than the Higgs self-coupling, the 4W vertex differs from that in the standard model. In this limit the leading corrections are not related to the divergences of the gauged nonlinear σ model.

13072 **Effective hadron theories from a quark model.** Gardner, S.; Moniz, E.J. (Center for Theoretical Physics, Laboratory for Nuclear Science Idge, Massachusetts 02139). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2504-2509(Dec 1987).

In the context of the quark exchange model of Lenz et al., effective hadron theories are constructed and the resulting physical observables compared to their "experimental" values as defined by the calculations using the exact quark model operators. This model study illustrates convergence issues for an effective hadron basis in a quark model in which all physical observables can be computed exactly.

13073 **Fowler et al. reply.** Fowler, G.N.; Friedlander, E.M.; Weiner, R.M.; Wilk, G. (University of Exeter, Exeter, England). *Physical Review Letters;* **59**: No. 20, 2382-2382(16 Nov 1987).

The authors defend their two-component convolution model to descibe multiplicity distributions of hadron-hadron interactions. (AIP)

13074 **Simple predictive model for flavor production in hadronization.** Buchanan, C.D.; Chun, S.B. (Department of Physics, University of California, Los Angeles, California). *Physical Review Letters;* **59**: No. 18, 1997-2000(2 Nov 1987).

We have found a simple powerful Ansatz, interpreting the Lund symmetric-fragmentation function as a universal production density, which predicts multiplicities and momentum and P/sub T/^{2} distributions of the many meson and baryon flavors observed in e^+e^- collisions at E/sub c.m./≅30 GeV almost perfectly with only two "natural" parameters of the Lund symmetric-fragmentation function. The model depends only on hadron masses and not on quark-level suppression factors such as s/u or qq/q. At a minimum, it provides an easy basis for the prediction of particle production rates and distributions, and may provide insight into the actual production mechanism.

13075 **Complex moments of parton distributions and new sum rules.** Bourrely, C.; Soffer, J.; Wu, T.T. (Centre de Physique Theorique, Luminy, 13288 Marseille Cedex 9, France). *Physical Review Letters;* **59**: No. 18, 2009-2011(2 Nov 1987).

The Q^2 evolution of quark and gluon distributions predicted by perturbative QCD is reexamined by consideration of the complex moments of these distributions. This analytic continuation leads us to derive several interesting new sum rules which depend on the number of flavors.

13076 **Perturbative quantum chromodynamic prediction for the heavy quark fragmentation function.** Amiri, F.; Ji, C.R. (Stanford Linear Accelerator Center, CA, USA; Stanford Univ., CA, USA. Inst. of Theoretical Physics). *Physics Letters [Section] B;* **195**: No. 4, 593-598(17 Sep 1987). Contract AC03-76SF00515;AC07-76ET10723.

Within the framework of a particular model for meson production, a perturbative QCD analysis is presented for the inclusive production of pseudoscalar and vector mesons to derive the fragmentation function of heavy quarks produced in e/sup +/e/sup -/ annihilation. The results are compared with experimental data for bottom and charm quark fragmentation functions.

13077 **B-anti B mixing and relations among quark masses, angles and phases.** Harari, H.; Nir, Y. (Stanford Linear Accelerator Center, CA, USA). *Physics Letters [Section] B;* **195**: No. 4, 586-592(17 Sep 1987). Contract AC03-76SF00515.

Using the recent data on B/sub d//sup 0/-anti B/sub d//sup 0/ mixing we establish constraints on the allowed values of the standard model parameters m/sub t/, θ/sub 13/ and δ. The allowed range is inconsistent with the Stech scheme for the quark mass matrices. For almost all allowed values of the parameters, the Fritzsch form of the mass matrices is also excluded. Only in the unlikely event that the experimental and theoretical quantities chi/sub d/, m/sub s//m/sub b/, θ/sub 23/, B/sub K/ and f/sub B/ assume extreme values within their allowed ranges, a set of parameters exists which is consistent with all data and with the Fritzsch scheme. We then obtain the unique solution m/sub t/ ≅ 85 GeV, sinθ/sub 13/ ≅ 0.0035, δ ≅ 100/sup 0/, yielding Γ(b -> ulanti ν/sub l/)/Γ(b -> clanti ν) ≅ 0.01, maximal B/sub s//sup 0/-anti B/sub s//sup 0/ mixing, relatively small ϵ'/ϵ and BR(K -> πνanti ν) ≅ 1x10/sup -10/.

13078 **Pion as a probe of nuclear structure, what we have and have not learned.** Bowman, J.D. (Los Alamos National Lab., NM, USA). pp 83-97 of Proceedings of the international nuclear physics conference, Harrogate, U.K., 25-30 August 1986. V.2. Invited papers. Durell, J.L.; Irvine, J.M.; Morrison, G.C. (eds.). Bristol, England; Inst. of Physics (1987). (CONF-860802—).

From International nuclear physics conference; Harrogate, UK (25 Aug 1986).

Experiments that have used the pion as a probe of nuclear structure are discussed. The subject is divided into five parts: (1) properties of the pion and the pion-nucleon interaction, (2) studies of the isospin mixing and neutron-to-proton matrix element ratios in inelastic scattering, (3) studies of isovector giant resonances in pion single-charge-exchange reactions, (4) the search for six-quark structures in the nucleus using pion double-charge-exchange reactions, and (5) concluding remarks.

13079 **Strange probes of the nucleus.** Dover, C.B. (Brookhaven National Lab., Upton, NY, USA). pp 99-118 of Proceedings of the international nuclear physics conference, Harrogate, U.K., 25-30 August 1986. V.2. Invited papers. Durell, J.L.; Irvine, J.M.; Morrison, G.C. (eds.). Bristol, England; Inst. of Physics (1987). (CONF-860802—).

From International nuclear physics conference; Harrogate, UK (25 Aug 1986).

Recent experimental and theoretical advances in hypernuclear physics are reviewed. An appraisal is given of various suggestions for using strange probes to test partial quark deconfinement in

nuclei and meson exchange vs. quark-gluon exchange descriptions of baryon-baryon interactions.

13080 **SSC physics signatures and trigger requirements.** Kane, G.; Paige, F.; Price, L.; Goodman, M.; Baer, H.; Bellochi, G.; Beretvas, A.; Berger, E.; Collins, J.; Diebold, R. (Univ. of Michigan). pp 1-22 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

For the two examples considered the authors have found achievable sequences of trigger requirements that result in a final trigger rate of 1 Hz or below, while preserving a reasonable fraction of the suggested new physics in the data sample. Several simplifications have been made in these calculations which should be removed as further work is done on simulating triggering for the SSC. Of primary importance among these future improvements is a realistic simulation of the detector. The detector simulation will naturally become increasingly credible as detectors are outlined and then designed for the purpose, but initially the parameters of a realistic detector can be drawn from CERN and FNAL collider detectors. The effect of overlapping events in the various detector elements should also be examined in more detail.

13081 **Hard scattering and a diffractive trigger.** Berger, E.; Collins, J.; Soper, D.E.; Sterman, G. (High-Energy Physics Div., Argonne National Lab., Argonne, IL 60439). pp 42-45 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The authors recently investigated the properties of hard scattering in diffractively produced systems, and in this note they summarize their conclusions. They are presented in detail. They show how perturbative QCD applied to such processes and present the results of some numerical calculations for heavy flavor production. It should be emphasized, however, that the authors' methods apply to diffractive hard scattering in general, and not only to heavy flavor production. Heavy flavor production is not a particularly special case, except that it is predominantly a gluon-initiated process.

13082 **Higgs mediated CP violation, discrete symmetries and rare decays.** Deshpande, N.G. (Institute of Theoretical Science, University of Oregon, Eugene, OR 97403). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 917-925(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We first review the Weinberg model of CP violation and examine its status in the light of new measurements on ϵ'/ϵ. Predictions of this model for the electric dipole moment of the neutron (D/sub N/) and K_L decays are examined. We then present a model for the fermion masses based on permutation group S_4. The model is successful in calculating elements of the Kobayashi-Maskawa matrix. CP violations occur through neutral flavor changing massive Higgs bosons. Predictions of ϵ'/ϵ D-D-bar and B-B-bar mixing, D/sub N/; and the rates for rare processes like $K \to \mu e$ are presented.

13083 **Derivation of the Wolfenstein form of the Kobayashi-Maskawa matrix from the fermion masses.** Rosen, S.P. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 992-1000(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We use an empirical, perturbative approach to the fermion mass matrix to derive the Wolfenstein form of the KM matrix as a power series in the Cabibbo angle parameter $\lambda = \sin\theta$/sub C/. With the aid of an SU(3) family symmetry, we extend the theory to neutrinos and we make predictions about their Dirac masses and mixing angles.

13084 **CP violation: The standard model and left-right symmetric electroweak models.** Herczeg, P. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 904-916(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We review and discuss CP violation in the minimal standard model of the electroweak interactions, and in general left—right symmetric electroweak models based on the gauge group SU(2)/sub L/ x SU(2)/sub R/ x U(1). We show that in the left-right symmetric models the contribution to ϵ' due to W/sub L/-W/sub R/ mixing could be as large as the present experimental limit. Some other effects of W/sub L/-W/sub R/ mixing are also considered.

13085 **Seeking the quark-gluon plasma.** Goldhaber, A.S. (Institute for Theoretical Physics, State University of New York, Stony Brook, NY 11794-3840). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 21-30(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Tests of Quantum Chromodynamics depend upon reaching high temperature or high density regimes of matter. One method of reaching large densities of matter is heavy-ion reactions. Seeking the Quark-Gluon Plasma with heavy-ion reactions is discussed in this presentation.(AIP)

13086 **Problems with quantizing the Skyrmion: A critical review.** Ralston, J.P. (High Energy Physics Division, Argonne National Laboratory, Argonne, IL 60439). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 538-546(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We review the motivation and construction of the chiral soliton picture of baryons. We discuss the semi-classical quantization procedure of Adkins, Nappi and Witten and the stability of the semi-classical solution under the collective coordinate quantization. By studying the behavior in the chiral limit and specific numerical predictions, we conclude that the collective coordinate procedure is inadequate.

13087 **Antiproton-nucleus interaction.** Gibbs, W.R. (Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 574-583(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Several facets of antinucleon-nucleus interactions are explored. The topics treated are: coherent interactions, production of usual states and particles in the nuclear medium, and the creation of extreme states of matter by antimatter annihilation. It is found that temperatures of the magnitude necessary to achieve the predicted quark-gluon phase transition are obtained.

13088 **Quantum chromodynamic evolution of multiquark systems.** Ji, C.; Brodsky, S.J. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 596-605(15 Nov 1984). (CONF-8405193—). Contract AC03-76SF00515.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We present a new technique which extends the quantum chromodynamic evolution formalism in order to predict the short distance behavior of multiquark wavefunctions. In particular, predictions are given for the deuteron reduced form factor in the high

momentum transfer region, and rigorous constraints on the short distance effective force between two baryons are predicted. These new techniques can be generalized in order to analyze the short distance behavior of multibaryon systems.

13089 **Search for possible 6-q states via inclusive reactions.** Bhatia, T.S. (Texas A & M University, College Station, TX 77843). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 628-633(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A satisfactory understanding of the 6-q system is necessary for a complete understanding of the short-range part of the NN interaction. Bag models and quark potential models predict 6-q states in the 2-3 GeV mass range. NNπ and NN$\pi\pi$ are examples of 6-q states involving the same quark flavors as the NN system, search for which could be undertaken through inclusive spin-dependent measurements.

13090 **Nucleon-nucleon interactions and quarks: Isospin violations arising from quark interchange.** Hwang, W.P.; Macfarlane, M.H.; Walker, G.E. (Nuclear Theory Center, Department of Physics, Indiana University, Bloomington, Indiana 47405). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 634-644(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We have developed a formalism for describing isospin violations in nucleon-nucleon interactions. It is emphasized that quark interchange, or percolation, gives rise to isospin-violating effects in nucleon-nucleon interactions. it is also pointed out that such isospin violation studies allow us to distinguish percolation effects from other categories of new physics.

13091 **Unitary, unified models for NN → NNπ.** Silbar, R.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 645-652(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

First-generation unitary, unified models reproduce the new NN → NNπ data reasonably well, but there are two interesting "warts" in the comparison of theory and experiment.

13092 **Chiral soliton bag model of nucleons.** Seki, R.; Ohta, S. (California State University, Northridge, California and W. K. Kellogg Laboratory, California Institute of Technology, California). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 653-655(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

As a possible phenomenological model of nucleons, a model Lagrangian is numerically solved in the semiclassical approximation using the hedgehog ansatz. Soliton solutions with winding numbers Z = 0 and 1 are examined as functions of the pion decay constant. The Z = 0 solution is similar to the cloudy bag model, but the Z = 1 solution is quite different from the little (chiral) bag model.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 13069, 13126, 13131, 13132, 13134, 13142

13093 **(BONN-HE—87-14) Chiral symmetry breaking beyond the Landau gauge.** Atkinson, D.; Johnson, P.W.; Stam, K. (Rijksuniversiteit Groningen, Netherlands. Inst. for Theoretical Physics). (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jul 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751957/JAW.

By using the novel Ansaetze for the longitudinal and transverse parts of the fermion-gauge boson vertex that respect the Ward identity and multiplicative renormalizibility, we demonstrate that chiral symmetry breaking occurs in vector-like gauge theories in such a way that the critical coupling constant and dynamical mass function are gauge-independent, at least in leading order.

13094 **Operatorial Chan-Paton factors.** Clavelli, L.; Cox, P.H.; Harms, B. (Department of Physics and Astronomy, University of Alabama, Tuscaloosa, Alabama 35487). *Physical Review [Section] D: Particles and Fields;* **36**: No. 12, 3747-3754(15 Dec 1987).

We present a detailed Fock-space realization of the operatorial Chan-Paton factors suggested in a functional integral approach by Marcus and Sagnotti. The twist operator is explicitly constructed for the cases of SO(2/sup D//sup /2/) and USp(2/sup D//sup / 2/) internal symmetries for any even integer D.

13095 **Heavy-Z-boson decays to two bosons in E_6 superstring models.** Barger, V.; Whisnant, K. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review [Section] D: Particles and Fields;* **36**: No. 11, 3429-3437(1 Dec 1987).

We evaluate the decays of a heavy neutral gauge boson Z_θ into W^+W^-, the Z and a Higgs boson, or two Higgs bosons in superstring-inspired electroweak models with an extra U(1) gauge group, two Higgs doublets, and a Higgs singlet. The branching ratios for these processes are generally similar and two-boson decay modes of Z_θ must exist at the few-percent level if kinematically accessible, although the bosonic modes which dominate in any given scenario depend on the U(1) quantum numbers and mixing in the Higgs sector. Lower bounds on the Z_θ mass versus the Z,Z' mixing are discussed; for the no-scale superstring model, M/sub Z//sub =/ must be above 550 GeV.

13096 **Unitarity bound on the scale of fermion mass generation.** Appelquist, T.; Chanowitz, M.S. (Department of Physics, Yale University, New Haven, Connecticut 06520). *Physical Review Letters;* **59**: No. 21, 2405-2407(23 Nov 1987).

Partial-wave unitarity implies an upper limit on the energy scale of the mechanism that generates quark and lepton masses.

13097 **Structure of N = 2 superconformally invariant unitary "minimal" theories: Operator algebra and correlation functions.** Kiritsis, E.B. (California Institute of Technology, Pasadena, California 91125). *Physical Review [Section] D: Particles and Fields;* **36**: No. 10, 3048-3065(15 Nov 1987).

N = 2 superconformal-invariant theories are studied and their general structure is analyzed. The geometry of N = 2 complex superspace is developed as a tool to study the correlation functions of the theories above. The Ward identities of the global N = 2 superconformal symmetry are solved, to restrict the form of correlation functions. Advantage is taken of the existence of the degenerate operators to derive the "fusion" rules for the unitary minimal systems with c-italic-tilde<1. In particular, the closure of the operator algebra for such systems is shown. The c-italic-tilde = (1/3 minimal system is analyzed and its two-, three-, and four-point functions as well as its operator algebra are calculated explicitly.

6454 Field Theory

REFER ALSO TO CITATION(S) 11907, 12883, 12904, 13011, 13029, 13075, 13095, 13097, 13599

13098 **(ANL-HEP-CP—87-68) Reggeon Field Theory and the phases of QCD.** White, A.R. (Argonne National Lab., IL (USA)). 21 Jul 1987. Contract W-31109-ENG-38. 21p. (CONF-8707136—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88002908/JAW.

From 10. workshop on high energy physics and field theory; Protvino, USSR (6 Jul 1987).

We propose a Reggeon Field Theory phase diagram involving Sub-critical and Super-critical Pomeron behavior and the Expanding Disc. We describe the derivation of Reggeon Field Theory from QCD using infra-red analysis of the reggeon diagrams of the spontaneously broken theory. Matching the Reggeon Field Theory phase-diagram to that of lattice QCD with many fermions has sig-

nificant implications for the chiral properties of continuum QCD when the number of flavors is less than the maximum allowed by asymptotic freedom. 19 refs., 7 figs.

13099 **(BONN-HE—87-16) SU(2) x SU(2) structures in two-dimensional critical systems.** Christe, P. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Aug 1987. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751918/JAW.

A detailed analysis of selection rules for the operator product expansion and of closed operator algebras in unitary and non-unitary critical statistical systems with Virasoro central charge c<1 is presented. The four point correlations constructed by Dotsenko and Fateev are related to those of a SU(2) x SU(2) Wess-Zumino-Witten model. Implementing the constraint of locality on the correlation functions gives rise to equivalent monodromy structures. This implies the existence of a unique correspondence between the selection rules and the operator algebras in both models. Previous results on the SU(2) Wess-Zumino-Witten model allow to determine the rich algebraic structures of the statistical systems.

13100 **(DESY—87-004) Chiral anomaly from the Fokker-Planck formalism.** Magpantay, J.A.; Reuter, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jan 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751958/JAW.

We show how chiral anomalies arise in the Fokker-Planck formulation of stochastic quantization. Starting from a noise correlation function which is non-local in real space-time, a gauge invariantly regularized Fokker-Planck Hamiltonian is derived and used to compute the anomaly.

13101 **(EFI—910(61)-86) New method of supersymmetric and gauge-invariant regularization.** Egoryan, E.S.; Manvelyan, R.P. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700962/JAW.

A new method of gauge and N-2 supergauge invariant regularization based on stochastic quantization and stochastic regularization is proposed. 14 refs.

13102 **(EFI—936(87)-86) On the three-dimensional Ising model.** Kavalov, A.R.; Sedrakyan, A.G. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700973/JAW.

The three-dimensional Ising gauge model is reformulated as the theory of surfaces with fermionic structure on them. In the naive continuum limit the action of the resulting string theory is defined by the Dirac action induced on two-dimensional surface. 6 refs.

13103 **(IFVE-ONF—86-83) Dynamic conservation of anomalous current in gauge theories.** Kulikov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701051/JAW.

Submitted to the journal Theor. Math. Phys. .

The symmetry of classical Lagrangian of gauge fields is shown to lead in quantum theory to certain limitations for the fields interacting with gauge ones. Due to this property, additional terms appear in the effective action in the theories with anomalous currents and its gauge invariance is ensured. 6 refs.

13104 **(IFVE-OTF—86-189) Massive Gross-Neveu model in the leading order of 1/N expansion. Consideration for temperature and chemical potential.** Klimenko, K.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701302/JAW.

Submitted to the journal Theor. Mat. Fiz. .

Massive Gross-Neveu Model is considered in a self-consistent way in a leading order of 1/N expansion. Properties of the model due to finite temperature and chemical potential are studied. It is shown that a critical value a/sub C/ of chemical potential exists. At a/sub C/ we have a gap in the fermion mass behaviour. 9 refs.

13105 **(IFVE-OTF—87-43) Classical non-Abelian solutions for nonstandard Lagrangians.** Alekseev, A.I.; Vshivtsev, A.S.; Tatarinov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; Moskovskij Inst. Radiotekhniki, Ehlektroniki i Avtomatiki, USSR). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701305/JAW.

The solutions of field equations of motion are obtained for a definite class of effective Lagrangian is standard Wu-Yang anzatz for vector-potential. It is shown that real monopole and dyon type solutions can be obtained without introducing additional interaction with Higgs fields. The dyon configuration having a vanishing field density is found. The field equations of motion which can be expressed as a series in inverse powers of distance are investigated. The rearrangement of pure chromomagnetic field is shown to be energetically preferable to the configuration including a chromoelectric field component. Pure chromoelectric field configurations with distributed charge density are also investigated. 20 refs.; 6 refs.

13106 **(IFVE-OTF—87-46) Color charge motion in non-Abelian fields.** Alekseev, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701306/JAW.

The problem of the motion of a probe color charge in a static non-Abelian spherically symmetrtic field configuration (Wu-Yang anzatz for vector-potential) has been reduced to the problem of an electrically charged particle motion in effective electromagnetic field with an additional interaction of a definite form. The motion of the color particle is investigated for a pure monopole chromomagnetic field with unfixed chromoelectric field, for the case of zero total angular momentum for dyon point-like field configurations, for the constant color vector, for chromoelectric field configurations. 18 refs.; 2 figs.

13107 **(IFVE-OTF—87-47) Fermionic terms in the open superstring effective action.** Metsaev, R.R.; Rakhmanov, M.A. (Moskovskij Gosudarstvennyj Univ., USSR). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701307/JAW.

An effective action in the a'/sup 2/-order in abelian case for the massless modes of the open superstring has been obtained. It has been found from comparison with the known superstring 4-particles scattering amplitudes. Independently the authors computed it by supersymmetrization of the bosonic F/sup 4/-terms found previously. The standard supersymmetry transformations are modified by the order of a'-terms. The field redefinition ambiguity present in the effective action is discussed. 11 refs.

13108 **(ITEF—49(1987)) Supersymmetric instanton calculus. Gauge theories with matter in an arbitrary group.** Novikov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701369/JAW.

Superfield formalism for instantons in supersymmetric gauge theories with matter, is developed. The way to include matter in the simplest representations in supergauge theories with SU(N) group, is shown. The results are generalized for an arbitrary group. 18 refs.

13109 **(ITEF—178(1986)) Kac - Moody algebras. Central extensions, cohomologies and vertex operator representation of free fermions.** Lebedev, D.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 31p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701374/JAW.

The results from the theory of representations of Kac-Moody algebras are presented. Definitions and simplest properties of current algebras and Kac - Moody algebras are given. The main ieas of vertex operator plotting from the theory of representations of free fermions and current algebras are illustrated. Application of vertex operators in "principal" realization to plotting the solitons of N hierarchies of Korteweg-de-Vries equations is described. 30 refs.

13110 **(ITEP—16(1987)) Statistical sums of strings on hyperellyptic surfaces.** Lebedev, D.; Morozov, A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701120/JAW.

Contributions of hyperellyptic surfaces to statistical sums of string theories are presented. Available results on hyperellyptic surface give the apportunity to check factorization of three-loop statsum. Some remarks on the vanishing statistical sum are presented. 8 refs.

13111 **(ITEP—22(1987)) Field theory of interacting open superstrings of fermionic ghost representation.** Aref'eva, I.Ya.; Medvedev, P.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701122/JAW.

Field theory of interacting open superstring in fermionic ghost representation based on anticommuting and commuting ghosts corresponding respectively to world sheet bosonic x/sub μ/ and fermionic phi/sub μ/ coordinates is presented. The author have to revise once more the field theory of the free Ramond (R) string and starting from general algebraic point of view they obtain that the number of degrees of freedom in the R and NS (Neveu-Schwartz) sectors equalise themselves permitting to construct a supersymmetric operator. It is proposed to solve a specific equation guaranteeing superinvariance in order to find the R-R-NS and NS-R-R vertices in the term of the NS-NS-NS vertex. 26 refs.

13112 **(ITEP—41(1987)) Instantons and confinement in the SU(2) lattice gauge theory.** Polikarpov, M.I.; Veselov, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701377/JAW.

Properties of gauge field configurations obtained by freezing the quantum fluctuations of the gauge fields on the lattice are studied. The freezing process is subdivided into three regions: instanton-anti-instanton vacuum, the annihilation of (anti)instantons, classical solutions. The distribution of instanton sizes, rho, and the distribution of interinstanton distances, R, are obtained. The average value of the ratio R/rho is 2.3. The contribution of the multiinstanton configurations into the value of the string tension is 5%. 17 refs.; 8 figs.

13113 **(ITEP—81(1986)) Rotary motions of closed relativistic string and vacuum trajectories.** Vladimirskij, V.V.; Il'ina, I.L.; Kiklevich, E.A.; Nikolaevskij, E.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701124/JAW.

Solutions are obtained for a closed relativistic string with a scalar field. There is an infinite series of branches of rotary-type solutions distinguished by the number n of periods per revolution and by symmetry. Stability of solutions was investigated. The Regge trajectories of these branches have a limiting envelope which may be compared with the Pomeranchuk pole trajectory. The slope of the limiting envelope is four times smaller than the slope of the leading Regge trajectory. This result is independent of the string model details. The quantum effects shifting the limiting trajectory are estimated. 9 refs.; 5 figs.

13114 **(ITEP—99(1987)) Quark propagators and correlators in a confining vacuum.** Simonov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701378/JAW.

Quark propagators, quark-antiquark Green functions and photon selfenergy operator PI/sup (2)/(k) are considered in the background (anti)selfdual field. The cases of a homogeneous selfdual field in d=4 and magnetic field in d=2 are studied in detail. Isolated quarks and quark-antiquark pairs are shown to be confined in those cases with the quadratic form of confining potential. In the space filled with domains of the homogeneous field with random directions the confining potential is of linear form, and the colorless qq-bar pair is not confined. 24 refs.

13115 **(ITEP—118(1986)) Effective zero-mode hamiltonian in supersymmetric chiral non-Abelian gauge theories.** Blok, B.Yu.; Smilga, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701125/JAW.

The effective Hamiltonian for supersymmetric chiral gauge theories placed in the finite space box of size L much less than the confinement length A/sup -1/ is constructed. Two examples are discussed: the theory with the gauge group SU(3) involving 7 left-handed triplets and a right-handed sextet and the SU(5) theory involving a left-handed quintet and a right-handed decuplet. The second example is the most interesting as there are strong indications that supersymmetry is spontaneously broken in this theory due to dynamical effects. The effective hamiltonians, analogous to the hamiltonian of the chiral supersymmetric QED, display the lattice structure in the space of weights of the gauge group. Unfortunately, they are very complicated and we did not succeed in calculating reliably the Witten index for these hamiltonians and are unable to reveal supersymmetry breaking in the SU(5) model and its absence in the SU(3) model in this approach. 13 refs.

13116 **(ITEP—171(1986)) Perturbative corrections to effective zero-mode Hamiltonian in supersymmetric QED.** Smilga, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701127/JAW.

Supersymmetric QED in the finite volume is considered. In this problem the dynamic variables can be divided in two classes: "slow variables" (the zero momentum Fourier-harmonic of the electromagnetic field A/sub i//sup (o)/ and its supersymmetric counterpart) and "fast variables" (all others). The effective hamiltonian involving only slow variables can be constructed in the framework of the Born-Oppenheimer approach. In the lowest nontrivial order it describes free motion in the space of A/sub i//sup (o)/. Corrections in the Born-Oppenheimer parameter to the effective hamiltonian are found. They do not vanish and the resultant H-circumflex/sup eff/ describes a nontrivial N=2 supersymmetric extension of σ-model on a 3-dimensional conformally flat manifold. The possibility of such an extension has escaped ettention so far. The corrections to the effective hamiltonian of the chiral (0+1)-dimensional supersymmetric QED are calculated. 7 refs.

13117 **(ITEP—180(1985)) On decay of false vacuum catalized by particles.** Selivanov, K.G.; Voloshin, M.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701128/JAW.

In a two-dimensional theory the rate of metastable (false) vacuum decay induced by presence of a particle (either a boson or a fermion) and also by a collision of two particles is calculated. It is shown that the decay is effectively catalized by masses of the parti-

cles while their kinetic energy does not enhance the decay rate. We also give a physical interpretation of this result which suggests that the same behaviour should persist in higher dimensions. 11 refs.; 3 figs.

13118 **(ITEP—182(1986)) Statistical sums for open and/or oriented strings.** Morozov, A.; Roslyj, A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701380/JAW.

Embedding of module spaces of open (with boundaries) and/or non-orientable surfaces into those of closed orientable surfaces is described. This suggests a natural expression of contributions to statistical sums for bosonic strings in terms of Mamford measure. 3 refs.; 1 fig.

13119 **(JINR-E—2-87-132) On a generalization of renormalization group equations to quantum field theories of an arbitraty type.** Kazakov, D.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701143/JAW.

Submitted to the journal Theor. Math. Phys. .

A generalization of renormalization group equations to the theories with arbitrary Lagrangians including nonrenormalizable ones is presented. In the framework of dimensional regularization these equations enable us to determine the coefficient functions of higher poles starting from a simple pole or generalized β-functions. 11 refs.

13120 **(JINR-E—2-87-227) Hadron static properties in the model considering the structure of QCD vacuum.** Dorokhov, A.E.; Kochelev, N.I. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Theoretical Physics; AN Kazakhskoj SSR, Alma-Ata. Inst. Fiziki Vysokikh Ehnergij). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701144/JAW.

The model taking into account the interaction of quarks with QCD vacuum fields is applied to calculate the mean-square charge radii, magnetic moments and axial-vector constants of the hadron interaction. It is shown that one-particle contributions of these characteristics describe the experimental data with 20% accuracy. 13 refs.; 2 tabs.

13121 **(JINR-R—2-86-830) To the field theory with a fundamental mass.** Ibadov, R.M.; Kadyshevskij, V.G. (Samarkandskij Gosudarstvennyj Univ., USSR). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701159/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

This paper is a continuation of the investigations along the lines of constructing a consistent field theory with fundamental mass M - a hypothetical universal scale in the ultrahigh energy region. Earlier, in the developed approach the key role was played by the de Sitter momentum space of radius M. In this paper a quantum version of this idea is worked out: p-space is assumed to be a de Sitter one like before; however, the four-momentum p/sub μ/ is treated as a quantum mechanical operator in $\delta/\delta x$/sup μ/ only. 18 refs.

13122 **(JINR-R—2-87-34) Theory of relativistic string with ghost degrees of freedom.** Isaev, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701160/JAW.

Submitted to the journal Nucl. Phys. B.

Quantum and classical dynamics of a boson relativistic string (RS) with ghost degrees of freedom is considered. Local integrals of motion of sucha string and the solution of the Cauchy problem have been constructed. The integral representation for RS propagator has been obtained on the basis of the Cauchy problem solution. These results can become a base for a new approach to the construction of the field theory of interacting strings. A universal character of string investigation methods presented in this paper is marked. In particular, these methods are easily extended to a fermion string case. 21 refs.

13123 **(JINR-R—2-87-216) Form factors of oscillator states from QCD sum rules.** Bejlin, V.A.; Radyushkin, A.V. (Rostovskij-na-Donu Gosudarstvennyj Univ., USSR; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Theoretical Physics). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701161/JAW.

The QCD sum rule method is used to determine the form factor and the mean square radius of the ground state of the quantum mechanical oscillator. The results obtained for these parameters are in good ($\sim$ 10%) agreement with their exact values. The approach developed in this paper can be applied to calculate the charge radii of mesons. 9 refs.; 1 fig.

13124 **(KAERC—901/86) Unified model of the strong and electroweak interactions based on the gauge group SU(18)/sub L/ x SU(18)/sub R/.** Kim Il Kang. (Kim Il Sung Univ., D.P.R. of Korea). (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). 30 May 1986. 5p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701394/JAW.

On the basis of semi-simple gauge group G=SU(18)/sub L/ x SU(18)/sub R/ the unified theory of strong, weak and electromagnetic fields is constructed, and it is shown that the Weinberg angle and the energy of unification are in good agreement with the experimental values.

13125 **(LA-UR—87-3941) Looking for new gravitational forces with antiprotons.** Nieto, M.M.; Bonner, B.E. (Los Alamos National Lab., NM (USA); Rice Univ., Houston, TX (USA)). 1987. Contract W-7405-ENG-36. 15p. (CONF-8710125—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003154/JAW.

From 2. review and planning workshop on antiproton science and technology; Santa Monica, CA, USA (6 Oct 1987).

Quite general arguments based on the principle of equivalence and modern field theory show that it is possible for the gravitational acceleration of antimatter to be different than that for matter. Further, there is no experimental evidence to rule out the possibility. In fact, some evidence indicates there may be unexpected effects. Thus, the planned experiment to measure the gravitational acceleration of antiprotons is of fundamental importance. 20 refs., 3 figs.

13126 **(LAPP-TH—184-87) Geometric approach to the (BRS-) differential algebras of supersymmetric YM-theories.** Gieres, F. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jan 1987. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751887/JAW.

The (BRS-) differential algebra of susy YM-theories is defined in terms of superfields and forms on rigid U(N)-superspace. For d = 4 and N = 1.2 we show that it projects to the "BRS-component field algebra in the WZ-gauge" without any supergauge fixing. In this process the supergeometry is destroyed with the result that the final algebra becomes a prototype for a differential algebra which cannot be associated with an ordinary Lie algebra.

13127 **(OUP—87-29) Quantized Dirac field interacting with a classical Maxwell field.** Kolsrud, M. (Oslo Univ. (Norway). Fysisk Inst.). Oct 1987. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751311/JAW.

The S operator for the quantized and the s matrix for the unquantized Dirac field, both fields interacting with an unquantized Maxwell field, are shown to be related in the following way: S=exp(-icdaggerkc) and s=exp(-ik). Here c is the column matrix of the particle operators, and k is a Hermitian matrix. With splitting of c into an electron and a positron part, a corresponding factorization

of S is performed. Exact expressions for the probability amplitude for various electron and/or positron processes are then obtained.

13128 **Casimir energies in M⁴≧/sup N/ for even N. Green's-function and zeta-function techniques.** Kantowski, R.; Milton, K.A. (Department of Physics and Astronomy, University of Oklahoma, Norman, Oklahoma 73019). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3712-3721(15 Dec 1987).

The Green's-function technique developed in the first paper in this series is generalized to apply to massive scalar, vector, second-order tensor, and Dirac spinor fields, as a preliminary to a full graviton calculation. The Casimir energies are of the form u/sub Casimir/ = (1/a⁴){α/sub N/lna/b)+β/sub N/], where N (even) is the dimension of the internal sphere, a is its radius, and b/sup -1/ is an ultraviolet cutoff (presumably at the Planck scale). The coefficient of the divergent logarithm, α/sub N/, is unambiguously obtained for each field considered. The Green's-function technique gives rise to no difficulties in the evaluation of imaginary-mass-mode contributions to the Casimir energy. In addition, a new, simplified zeta-function technique is presented which is very easily implemented by symbolic programs, and which, of course, gives the same results. An error in a previous zeta-function calculation of the Casimir energy for even N is pointed out.

13129 **Connection of some two-dimensional bosonic and fermionic models to scalar curvature.** Mishra, V.K.; Tanaka, K. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3722-3724(15 Dec 1987).

It is found that the equations of motion of a variety of two-dimensional bosonic and fermionic models are a consequence of the constancy of the scalar curvature.

13130 **Derivative expansion and the induced Chern-Simons term at finite temperature in 2+1 dimensions.** Babu, K.S.; Das, A.; Panigrahi, P. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3725-3730(15 Dec 1987).

We apply the method of derivative expansion of fermion determinants to compute the induced Chern-Simons term in (2+1)-dimensional field theories. The temperature dependence of the Chern-Simons term computed using real-time and imaginary-time methods is shown to be compatible with gauge invariance.

13131 **Lie-algebra cohomology and the Osp(1,12) structure in string theory.** Niemi, A.J. (Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3731-3741(15 Dec 1987). Contract AC03-76SF00098.

We construct an improved Becchi-Rouet-Stora-Tyutin (BRST) operator and present generalizations of the standard BRST quantization and the BRST approach to Lie-algebra cohomology. In particular, we show how Lie-algebra two-cocycles can be related to an Osp(1,12) generalization of the conventional BRST—anti-BRST algebra. As an application we consider open bosonic strings, and explicitly construct the improved BRST operator and the pertinent Osp(1,12) algebra. We conclude that the string is naturally defined in a (D = 28+2)-dimensional Parisi-Sourlas superspace, with phase-space Osp(1,12) invariance generalized into a spacetime Osp(27,12) covariance. We construct the Osp(27,12)-covariant physical string states and establish their equivalence with the conventional D = 26 transverse states through a quantum generalization of the Parisi-Sourlas dimensional reduction. We show how the additional two bosonic dimensions emerge from the conventional BRST approach and observe that the ghost number of Osp(1,12)-invariant physical states vanishes.

13132 **Is the nonlinear σ model the m/sub σ/→∞ limit of the linear σ model?.** Chan, L. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3755-3765(15 Dec 1987).

We propose to investigate whether the SO(N) nonlinear σ model is equivalent to the m/sub σ/→infinity limit of the linear σ model by comparing the corresponding one-loop effective-action expansions up to the four-derivative terms and including the symmetry-breaking term. For this purpose we use a new background-field method to calculate the effective-action expansion directly. In the case of the linear σ model, the renormalization procedure is implemented carefully before the m/sub σ/→∞ limit is taken. For the nonlinear σ model we introduce a new and intuitive covariant treatment for the perturbation calculation of the field theory with nonlinear constraint. We do not find any noninvariant terms in either case. We show that the divergent parts of the effective Lagrangians due to m/sub π/→0, m/sub σ/→∞, or N→∞ are equivalent in the two models. However, the nonleading finite parts of the effective Lagrangians are different. Therefore, the two operations, taking the m/sub σ/→∞ limit and calculating the quantum corrections, do not commute. The origin of this difference may be a violation of decoupling.

13133 **Empirical study of the hybrid-molecular-dynamics approach to the simulation of QCD.** Gottlieb, S.; Liu, W.; Toussaint, D.; Renken, R.L.; Sugar, R.L. (Department of Physics, Indiana University, Bloomington, Indiana 47405). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3797-3803(15 Dec 1987).

We study the tunneling rate of the hybrid-molecular-dynamics algorithm for the simulation of QCD at a first-order phase transition. We also present results for the effects on the simulation of step size and accuracy of evaluation of fermion Green's functions.

13134 **Numerical studies of the Faddeev-Popov determinant for different SU(n) groups.** Wang, K.C.; Cutkosky, R.E. (Physics Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 12, 3825-3827(15 Dec 1987).

We study the distribution of zeros of the Faddeev-Popov determinant and the properties of the Coulomb energy operator of QCD for the gauge groups SU(2), SU(3), and SU(4). Numerical results for these different gauge groups are compared.

13135 **Spin splittings of heavy-quark bound states from lattice QCD.** Campostrini, M.; Moriarty, K.; Rebbi, C. (Istituto Nazionale di Fisica Nucleare, Sezione di Pisa, Pisa, Italy). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 11, 3450-3462(1 Dec 1987).

The spin-dependent potentials which determine the spin splittings of heavy-quark bound states are evaluated by a lattice Monte Carlo calculation. One of the spin-orbit potentials is found to have a long-range nonperturbative component, while all other potentials exhibit a short-ranged perturbative behavior. Calculations at two different values of the bare coupling constant demonstrate scaling. The spin splittings that follow from the calculated potentials are evaluated. Good agreement is found with experimental data provided that vacuum-polarization effects from qq-bar pairs at short distances are taken into account.

13136 **Variational scalar and tensor lattice glueball masses.** DeGrand, T.A. (Physics Department, University of Colorado, Boulder, Colorado 80309). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 11, 3522-3525(1 Dec 1987).

Variational calculations are presented of the masses of the lightest scalar and tensor glueballs in quarkless SU(3) gauge theory at lattice coupling β = 6.0 on a large lattice. The scalar-glueball mass is consistent with previous nonvariational calculations on lattices of similar sizes. The tensor-glueball mass is greater than the scalar-glueball mass.

13137 **Quark-number susceptibility of high-temperature QCD.** Gottlieb, S.; Liu, W.; Toussaint, D.; Renken, R.L.; Sugar, R.L. (Department of Physics, Indiana University, Bloomington, Indiana 47405). *Physical Review Letters;* **59**: No. 20, 2247-2250(16 Nov 1987).

We measure the response of the quark number to an infinitesimal chemical potential in high-temperature QCD with two light

flavors of dynamical fermions. In the chirally symmetric phase the susceptibilities for quark number density and for the density of the third component of isospin are large and equal within statistics, which is consistent with a plasma of light quarks. In the broken-symmetry phase the susceptibility for quark number density is small, as expected from quark confinement.

13138 **Reduction formulas for coherent states.** Swanson, M.S. (Department of Physics, University of Connecticut, Stamford, Connecticut 06903). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 10, 3077-3085(15 Nov 1987).

The Lehmann-Symanzik-Zimmermann reduction formulas consistent with the use of asymptotic coherent states to model external fields are developed for the case that the in-state external field differs from the out-state external field. It is shown for the specific choice of coherent state considered that the reduction formulas deviate from the standard forms presented in textbooks. The coherent states are not reduced directly but instead are incorporated into the perturbative representation of the time-ordered product. An effective potential created by the coherent state is found which self-consistently determines the form of the asymptotic field. An application is made to the case of nonrelativistic quantum electrodynamics in a laser pulse.

13139 **Topological defects at finite temperature.** Bazeia, D.; Eboli, O.J.P.; Guerra, J.M. Jr.; Marques, G.C. (Departamento de Fsica, CCEN, Universidade da Paraba, CEP 58000, Joo Pessoa, Paraba, Brazil). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 10, 3086-3094(15 Nov 1987).

We obtain the phase diagram of gauge theories by studying the influence of topologically nontrivial boundary conditions. For this reason, we develop a scheme for computing the free energy of topological defects at finite temperature. As an application, the free energy of topological defects for the minimal SU(5) model are evaluated in the semiclassical approximation.

13140 **Static potential for smooth strings in the large-D limit.** Braaten, E.; Tse, S. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 10, 3102-3113(15 Nov 1987). Contract W-31-109-ENG-38.

The static potential V(R) in Polyakov's model of smooth strings is studied in the large-D limit. The physical string tension is calculated analytically as a function of the bare string tension and the extrinsic curvature coupling. A systematic saddle-point method for computing the loop expansion of V(R) is developed and carried out explicitly to two loops. There are no corrections to the 1/R Luscher term to this order. The leading short-distance behavior of V(R) is also proportional to 1/R with twice the coefficient of the Luscher term.

13141 **Initial-value problems in quantum field theory in the large-N approximation.** Cooper, F.; Mottola, E. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 10, 3114-3127(15 Nov 1987).

We derive the time-evolution equations appropriate to initial-value problems in $\lambda(\phi_\alpha \phi_\alpha)^2$ field theory at large N. The Heisenberg equations of motion for this theory are compared to the Schroedinger equation for a wave functional constrained to be in a Gaussian state [the time-dependent Hartree-Fock (TDHF) ansatz]. The TDHF ansatz corresponds to a special choice of initial conditions for the general large-N Heisenberg equations of motion. The renormalization of the theory is discussed in both approaches and a simple method is given to arrive at finite differential equations suitable for numerical integration forward in time. A necessary and sufficient general condition for these equations to be finite is that the initial state contain a finite average number of particles and/or correlated particle pairs per unit volume.

13142 **Absence of spontaneous parity violations in three-dimensional QED induced by infrared effects.** Cho, H.T. (Department of Physics, Brown University, Providence, Rhode Island 02912). *Physical Review* [*Section*] *D: Particles and Fields;* **36**: No. 10, 3260-3267(15 Nov 1987).

The possibility of dynamical parity violations in three-dimensional QED (QED_3) by infrared effects is examined using a previously defined infrared approximation. <psi-barpsi> and the photon propagator D-tilde/sub $\mu\nu$(p) are calculated in this approximation for the mass of the fermion, mnot =0. Then, as m→0, <psi-barpsi> is found to be zero and D-italic-tilde/sub $\mu\nu$(p) to have a pole corresponding to zero mass. These results imply that there are no dynamical violations of parity induced by infrared effects in QED_3.

13143 **Covariant one-loop fermion emission amplitudes in closed string theories.** Atick, J.J.; Sen, A. (Stanford Univ., CA, USA. Inst. of Theoretical Physics; Stanford Linear Accelerator Center, CA, USA). *Nuclear Physics* [*Section*] *B;* **293**: No. 2, 317-347(9 Nov 1987). Contract AC03-76SF00515.

We calculate the 2 fermion-2 boson and the 4 fermion scattering amplitudes at one loop in the NSR formulation of the heterotic and type II superstring theories using the covariant fermion emission vertex. The results are shown to agree with well known amplitudes calculated in the light-cone gauge in the Green-Schwarz formulation. The agreement of the 4-fermion amplitude entails the use of a new θ-function identity which we also prove.

13144 **Large-scale quantum field theory calculations on supercomputers.** Moriarty, K.J.M.; Rebbi, C. (John Von Neumann National Supercomputer Center, Princeton, NJ, USA. Consortium for Scientific Computing; Brookhaven National Lab., Upton, NY, USA. Physics Dept.; Boston Univ., MA, USA. Dept. of Physics). *Computer Physics Communications;* **47**: No. 1, 75-82(Oct 1987). (CONF-8610363—). Contract AC02-76CH00016.

From New force in supercomputers executive seminar; Monte Carlo, Monaco (1 Oct 1986).

Large-scale calculations are used to evaluate the spin forces among quarks, from first principles. Applications to hadronic spectroscopy are discussed.

13145 **Family problems.** Goldman, T. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 895-903(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Even Grand Unified Theories may not explain the repetitive pattern of fermions in the Standard Model. The abysmal absence of dynamical information about these "families" is emphasized. The evidence that family quantum numbers exist, and are not conserved, is reviewed. It is argued that rare kaon decays may be the best means to obtain more information on this important question.

13146 **Overview of electron and muon physics sessions.** Souder, P.A. (Syracuse University, Syracuse, NY 13210). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1128-1133(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Topics on muon and electron physics discussed in the conference on Intersections Between Particle and Nuclear Physics (Steamboat Springs, 1984) are summarized. (AIP)

65 PHYSICS II

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 13380, 13479

13147 **(CONF-861193—6) Report of the Working Group Specialist's meeting on methods and practices in the field of nuclear data covariance.** Peelle, R.W. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002784/JAW.

From IAEA specialists' meeting on covariance methods and practices in the field of nuclear data; Rome, Italy (17 Nov 1986).

This paper discusses the need for nuclear data covariance files in various fields. The particular fields discussed are: fission reactor core physics, fast reactor shielding, fission reactor fuel cycle, fission power reactor pressure vessel surveillance, delayed neutron parameters for fission, fusion reactor blanket and shielding and fusion reactor dosimetry. Also discussed are the availability of sensitivity and uncertainty analysis techniques to utilize evaluated covariance files, covariance file processing codes and methods for evaluating nuclear data covariance quantiti. Topics on international cooperation are also discussed. (LSP)

13148 **(GSI—87-50-Prepr.) Space time evolution and thermodynamical aspects of intermediate energy nucleus-nucleus collisions.** Pochodzalla, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik). Aug 1987. 21p. (CONF-8704188—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751279/JAW.

From Symposium on central collisions and fragmentation processes; Denver, CO, USA (7 Apr 1987).

Recent experimental results on two-particle correlations measured in intermediate energy nucleus-nucleus collisions are reviewed. The emission and the sequential decay of particle unstable nuclei turn out to be an essential mechanism of the disintegration of nuclear systems. Consequences for single particle observables are discussed. In several experiments emission temperatures of about 5 MeV are found for /sup 5/Li nuclei. These surprising observations are compared to fragment temperatures calculated with a statistical multifragmentation model.

13149 (INIS-SU—431, pp 289) **Effective number of nucleons and clusters in nuclei extracted from the knock-out reactions initiated by pions.** Lantsev, I.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13150 (INIS-SU—431, pp 408) **Photoneutron yields from the /sup 2/H/sub 2/O, Be, /sup 238/U targets under the effect of bremsstrahlung of electrons with energy 4-8 Mev for the neutron escape angle 90 deg.** Golovkov, V.M.; Vasina, T.N.; Yakovlev, M.R. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13151 (INIS-SU—431, pp 339) **Energy dependence of different mechanism contribution to the preequilibrium (/sup 3/He,/sup 3/He') and (/sup 3/He,α) nuclear reactions.** Sukharevskij, V.G.; Khajmin, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13152 **(INT—184/P) Internuclear cascade in high energy collisions.** Kisielewska, D. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1984. 72p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701362/JAW.

The experimental analysis of the process of cascading in the target fragmentation region (TFR) is performed on the basis of the available experimental methods and data and the existing phenomenological models. The effect is studied separately for the deuteron and for the heavy nuclei. The following subjects are discussed: the experimental evidence for the existence of cascading phenomenon in TFR, the effective cascade cross section, the fraction of cascade interactions, multiplicity of particles produced through cascading and their rapidity distributions, the dependence of cascading on energy and on the type of projectile as well as on the size of the nucleus, the comparison with the phenomenological models and with other proposed mechanisms of particle production in TFR. The possibility of determining the hadronization time (formation time) through the study of the cascading process in TFR is pointed out. (author). 90 refs.

13153 **(ITEF—174(1986)) Correlations of protons and deuterons with deuterons in proton-nucleus interactions.** Vlasov, A.V.; Gavrilov, V.B.; Degtyarenko, P.V. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701373/JAW.

Correlation functions of protons and deuterons and two deutrons in the p(7.5 GeV/c)A -> pdx, p(7.5 GeV/c)A -> ddx reactions on C, Ti, Pb nuclei are measured. Dependence of correlation functions on momenta and exit angle of two particles is discussed. 11 refs.; 6 figs.

13154 **(JINR-R—6-87-202) Determination of physical constants of the ground state and quandrupole vibrational states and energy-level transitions in even-even deformed nuclei. Electric E2-transitions.** Adam, I.; Vagner, V.; Gonusek, M.; Krivopustov, M.I.; Morozov, V.A. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Nuclear Problems). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701172/JAW.

The formulae are obtained for reduced probabilities of the E2-intraband and interband electric transitions using of perturbation theory and assuming the mixing wave functions of ground, β- and γ-vibrational states and in equivalence value of intrinsic quadrupole moments of their states. 15 refs.; 4 figs.; 5 tabs.

13155 **(LUIP—8607) On the dependence between hadronization and nuclear fragmentation in hadron induced reactions.** Kumar, V.; Nilsson-Almqvist, B.; Otterlund, I.; Stenlund, E. (Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics). Sep 1986. 13p. (LUNDF6-NFFK—7076-1-12-1986). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751471/JAW.

Results from experiments on hadronic interactions with emulsion nuclei at different energies are compared with calculations from the Lund model for interactions between hadrons and nuclei. Special emphasis is put on the correlation between the hadronization and nuclear fragmentation. The model is able to describe many of the experimentally observed features, as shown by several examples. (authors).

13156 **Search for anti p-nucleus states using the (anti p,p) knock-out reaction at 600 MeV/c.** Aslanides, E.; Drake, D.M.; Peng, J.C.; Garreta, D.; Birien, P.; Bruge, G.; Catz, H.; Chaumeaux, A.; Janouin, S.; Legrand, D. (Centre de Physique des Particules, 13 - Marseille, France; Los Alamos National Lab., NM, USA). *Nuclear Physics [Section] A;* 470: No. 3/4, 445-460(31 Aug 1987).

The knock-out reaction A(anti p,p)X has been used to search for narrow anti p-nucleus states. The experiment was performed using the 600 MeV/c antiproton beam at LEAR and the high-resolution and large-acceptance magnetic spectrometer SPES II. The A-dependence of the annihilation-induced proton spectra has been studied on /sup 2/H, /sup 6/Li, /sup 12/C, /sup 63/Cu, /sup 208/Pb and /sup 209/Bi. The quasi-free elastic anti pp scattering observed in the lighter targets, and the comparison with the free anti pp scattering, also observed in this experiment, determine an effective proton number N/sub eff/ for 1s- and 1p-shell protons. No evidence for narrow bound or resonant anti p-nucleus states could be found. Upper limits for their production are one order of magnitude lower than certain theoretical predictions, but consistent with the properties of the anti p-nucleus interaction, as established from recent elastic and inelastic scattering as well as from studies of antiprotonic atoms.

13157 **Review of proton scattering and reactions.** Moss, J.M. (Los Alamos National Lab., NM, USA). pp 41-60 of Proceedings of the international nuclear physics conference, Harrogate, U.K., 25-30 August 1986. V.2. Invited papers. Durell, J.L.; Irvine, J.M.; Morrison, G.C. (eds.). Bristol, England; Inst. of Physics (1987). (CONF-860802—).

From International nuclear physics conference; Harrogate, UK (25 Aug 1986).

The review of proton scattering and reactions was presented at the International Nuclear Physics Conference, Harrogate, United Kingdom, 1986. Four continuum experiments are discussed, including: 1) missing Gamow-Teller Strength in the (p,n) continuum, 2) spin-flip strength in the (p,p') reactions at small momentum transfer, 3) search for excess pions, and 4) medium effects on continuum polarization observables. Some possible future developments are also described. (U.K.).

13158 **Summary talk covering application-oriented sessions.** Peelle, R.W. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 96: No. 1-4, 327-334(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Some of the successful data collection programs on specific problems are mentioned. These are actinide cross sections, fusion charged particle reactions, Lithium-7 breakup reactions, neutrons per fission, decay heat from fission products, the form of the fission spectrum and neutron scattering differential cross sections. Some trends in data-collecting experiments are mentioned. Data for applications are also summarized. These include neutron kerma data for neutrons above 10MeV, helium production from neutrons on Boron-10 and the resonance and thermal regions of fuel nuclides. (U.K.).

13159 **Heavy ion physics: Introduction to the heavy ion parallel sessions at CIPANP.** Schroeder, L.S.; Ludlam, T.W. (Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *AIP (American Institute of Physics) Conference Proceedings;* 123: No. 1, 1134-1137(15 Nov 1984). (CONF-8405193—). Contract AC03-76SF00098;AC02-76CH00016.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A brief introduction into some of the physics probed by heavy ion projectiles at low, intermediate and high energies is given. Emphasis is placed on nuclear matter under extreme conditions in this discussion, which should provide a common area of interest to both particle and nuclear physics.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 13159

13160 **(ANL/NDM—102) Investigation of the influence of the neutron spectrum in determinations of integral cross-section ratios.** Smith, D.L. (Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002623/JAW.

Ratio measurements are routinely employed in studies of neutron interaction processes in order to generate new differential cross-section data or to test existing differential cross-section information through examination of the corresponding response in integral neutron spectra. Interpretation of such data requires that careful attention be given to details of the neutron spectra involved in these measurements. Two specific tasks are undertaken in the present investigation: (1) Using perturbation theory, a formula is derived which permits one to relate the ratio measured in a realistic quasimonoenergetic spectrum to the desired pure monoenergetic ratio. This expression involves only the lowest-order moments of the neutron energy distribution and corresponding parameters which serve to characterize the energy dependence of the differential cross sections, quantities which can generally be estimated with reasonable precision from the uncorrected data or from auxiliary information. (2) Using covariance methods, a general formalism is developed for calculating the uncertainty of a measured integral cross-section ratio which involves an arbitrary neutron spectrum. This formalism is employed to further examine the conditions which influence the sensitivity of such measured ratios to details of the neutron spectra and to their uncertainties. Several numerical examples are presented in this report in order to illustrate these principles, and some general conclusion are drawn concerning the development and testing of neutron cross-section data by means of ratio experiments. 16 refs., 1 fig., 4 tabs.

13161 **(LA-UR—87-3488) Direct mass measurements of light neutron-rich nuclei using fast recoil spectrometers.** Vieira, D.J.; Wouters, J.M. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 11p. (CONF-870970—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003184/JAW.

From 5. international conference on nuclei far from stability; Lake Rosseau, Canada (14 Sep 1987).

Extensive new mass measurement capabilities have evolved with the development of recoil spectrometers. In the Z = 3 to 9 neutron-rich region alone, 12 neutron-rich nuclei have been determined for the first time by the fast-recoil direct mass measurement method. A recent experiment using the TOFI spectrometer illustrates this technique. A systematic investigation of nuclei that lie along or near the neutron-drip line has provided a valuable first glimpse into the nuclear structure of such nuclei. No evidence for a large single-particle energy gap at N = 14 is observed; however, a change in the two-neutron separation model calculations, and is interpreted in terms of the smaller 1s/sub 1/2/ - 1s/sub 1/2/ interaction compared to that of the 0d/sub 5/2/ - 0d/sub 5/2/ neutron-neutron interaction. 18 refs., 7 figs., 1 tab.

13162 **Summary of sessions on hypernuclei physics.** Eisenstein, R.A. (Carnegie-Mellon University, Pittsburgh, PA 15217). *AIP (American Institute of Physics) Conference Proceedings;* 123: No. 1, 1148-1154(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The Conference sessions on hypernuclear physics are summarized and reviewed. In all, six parallel sessions were devoted to this topic, ranging in subject matter from the elementary K-nucleon system to the hypernuclear many-body problem. The present status of the field was discussed, as were some of the future prospects. There is great promise for learning much new information about the many-body physics of strong interactions, specifically, nuclear systems in which lambda or sigma hyperon "impurities" have been implanted. However, presently it is clear that if the field is to achieve dramatic new successes, presently available facilities must be improved significantly.

13163 **Nucleon structure functions and electroweak interactions.** Souder, P.A. (Syracuse University, Syracuse, NY 13210). *AIP (American Institute of Physics) Conference Proceedings;* 123: No. 1, 490-498(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Experiments in which polarized electrons are scattered from nucleon and nuclear targets are reviewed. The results provide unique information about the structure of hadronic matter as well as about the fundamental electroweak interaction. Emphasis is placed on possible new directions in the field.

13164 **Heavy ions at steamboat: Summary of parallel sessions.** Ludlam, T. (Brookhaven National Laboratory, Upton, New York 11973). *AIP (American Institute of Physics) Conference Proceedings;* 123: No. 1, 1138-1147(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Use of heavy ion reactions to investigate the extremes of nuclear matter is discussed. (AIP)

6512 Nuclear Properties And Reactions, A=1-5, Experimental

13165 (INIS-SU—431, pp 297) **Recovery of /sup 3/He->ppn decay vertex function from the analysis of the /sup 3/He(p,d)pp reaction.** Avakov, G.V.; Belolipetskij, S.N.; Blokhintsev, L.D. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13166 (INIS-SU—431, pp 341) **Search for bound states and resonances in the /sup 3/n system.** Gorpinich, O.K.; Kadkin, E.P.; Kondrat'ev, S.N.; Saltykov, L.S.; Sklyarenko, V.D.; Tokarevskij, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13167 (INIS-SU—431, pp 343) **(d,n) reaction on /sup 4/He, /sup 9/Be and /sup 12/C nuclei.** Kadirov, F.; Kayumov, M.A.; Kayumov, Sh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13168 (INP—1266/PH) **Proton and antiproton interactions in hydrogen, argon and xenon at 200 GeV.** Malecki, P. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 78p. (In Polish). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701360/JAW.

The detailed analysis of the production of particles emitted into forward hemisphere in 200 GeV proton and antiproton interactions with hydrogen, argon and xenon targets is presented. Two-particle rapidity correlations and long-range multiplicity correlations are also discussed.

13169 (ITEF—29(1987)) **Analysis of the /sup 3/Hep -> pppn reaction at 5 GeV/c /sup 3/He momentum in pole model.** Abdullin, S.K.; Blinov, A.V.; Vanyushin, I.A and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701111/JAW.

The ITEP liquid-hydrogen 80-cm bubble chamber has been exposed to a separated beam of 5 GeV/c /sup 3/He nuclei. 7506 events of the /sup 3/Hep -> pppn reaction have been selected by means of a kinematical analysis. The basic experimental distributions have been compared with predictions of the pole-graph model taking into account the funal-state interaction of the spectators. 18 refs.; 6 figs.

13170 (JINR-R—1-87-191) **Prospects for the development of studies of relativistic hypernuclei at the synchrophasotron and the nuclotron.** Okonov, Eh.O. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701157/JAW.

The main prospects for a new approach in hypernuclear physics are analysed. This approach is proposed to use the possibility of relativistic hyperfragment production in accelerated nuclei beams. Taking into account the results of the performed calculations, some possible experiments using different detectors and triggering systems are considered. The proposed experimental programme in nuclear beams at the synchrophasotron and the nuclotron is briefly outlined: detection and study of the new hypernuclei with charge $Z>6$, measurements of their decay lifetimes, investigations of characteristics of their decays depending on Z, a search for unknown hypernuclei with strangeness $S \geq 2$ and for strange multiquark states as well. The expected results are discussed which can provide important information on the quark structure of nuclei and on the properties of hypothetical strange matter. 44 refs.; 7 figs.; 1 tab.

13171 **Tritium half-life measured by helium-3 growth.** Oliver, B.M.; Farrar, H. IV; Bretscher, M.M. (Rockwell International Corp., Canoga Park, CA, USA. Rocketdyne Div.; Argonne National Lab., IL, USA). *Applied Radiation and Isotopes;* **38**: No. 11, 959-965(1987).

Determinations of the tritium half life have been made by measuring the rate of /sup 3/He buildup in neutron-irradiated natural lithium. The measurement method, which is substantially diferent from those used previously, consisted of mass spectrometric measurements of the /sup 4/He//sup 3/He isotopic ratio in samples of lithium metal that had been irradiated in the core of a Triga reactor. Almost all of the /sup 3/He in the samples resulted from the decay of tritium produced by the /sup 6/Li(n,t)/sup 4/He and the /sup 7/Li(n, n't)/sup 4/He reactions, both of which yielded equal amounts of tritium and /sup 4/He. The helium isotopic ratio measurements, combined with the known decay times between irradiation and analysis, yielded an average tritium half life of 12.38 + - 0.03 mean solar years (1 solar year = 365.2422 days). This value is higher than several earlier half life measurements, but is consistent with a recent determination by the U.S. National Bureau of Standards.

13172 **Nuclear effects in muon scattering.** Montgomery, H.E. (Fermi National Accelerator Laboratory, Batavia, IL 60510). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 444-452(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The results of measurements of structure functions in iron and deuterium by the European Muon Collaboration are presented. In addition some newer data on the measurements of hadrons produced in the interaction of muons with nuclei are discussed. The prospects for future measurements at CERN and Fermilab are outlined.

13173 **Comparison of the total neutral energy spectra of $\alpha\alpha$, dd and pp interactions at the ISR.** (Brookhaven National Laboratory, Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 762-769(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The total neutral energy spectra, E/sub TOT//sub ^{0}/ = Σ_iE/sub i/^{0}, have been measured in the central region of $\alpha\alpha$, dd and pp interactions at $\sqrt{}$/sup s/NN = 31 GeV with an electromagnetic calorimeter covering 2π in azimuth. The data were collected in the light-ion run at the CERN ISR during August 1983. The cross section ratio of the $\alpha\alpha$ to the pp interactions increases rapidly wth E/sub TOT/^{0} from 7 to 10^3 in the range $1.5<$E/sub TOT/$^0<19$ GeV. The data are compared with a simple model of simultaneous multiple nucleon-nucleon collisions.

13174 **Detecting gamma rays from hypernuclei.** Chrien, R.E. (Brookhaven National Laboratory, Upton, New York, 11973, USA). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 841-849(15 Nov 1984). (CONF-8405193—). Contract AC02-76CH00016.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Electromagnetic radiation from p-shell hypernuclei has been detailed in the (K^-, $\pi^-\gamma$) reaction at the Brookhaven AGS. The technique makes it possible to characterize the spin-dependent terms in the Λ-N effective interaction.

13175 **Spin-polarized protons and deuterons in hydrogen-isotope solids.** Honig, A. (Physics Department, Syracuse University, Syracuse, NY 13210). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 1084-1089(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

New techniques for production of highly polarized HuparrowD, up-arrowDup-arrowD and up-arrowDup-arrowT solids in the 'frozen-spin' mode have been conceived and are under investigation, spurred by their potential application as nuclear fusion fuels. The up-arrowDup-arrowD methods are directly applicable to spin-physics targets, and up-arrowHup-arrowD targets superior to those previously described are expected from development of the new technique. The new techniques feature relaxation rate switching modes faster than the symmetry species conversion previously described (for example, radiation damage-anneal cycles), and epitaxial deposition of molecular isotopic variants on metastably polarized up-arrowHup-arrowD or up-arrowDup-arrowD blocks at T = 1-4K an in fractional Tesla holding fields, wherein spin diffusion produces high polarization in the deposited layer even in the presence of considerable heat generation from internal radiation or symmetry species conversion. Production of polarized up-arrowHup-arrowD and up-arrowDup-arrowD liquids appears feasible, as well as positively or negatively charged up-arrowH, up-arrowD and up-arrowT beams from ablation polarized solids.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

13176 (GSI—87-60-Prepr.) **Energy measurements in oxygen-induced reactions at 60 A GeV and 200 A GeV.** Albrecht, R.; Bock, R.; Claesson, G.; Gutbrod, H.H.; Kolb, B.W.; Lund, I.; Schmidt, H.R.; Siemiarczuk, T.; Awes, T.C.; Baktash, C. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Oak Ridge National Lab., TN (USA); Lund Univ. (Sweden); Muenster Univ. (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); Tennessee Univ., Knoxville (USA)). Oct 1987. 21p. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.

Results are presented from reactions of 60 A GeV and 200 A GeV /sup 16/O projectiles with C, Cu, Ag, and Au nuclei. Energy spectra measured at zero degrees and transverse energy distributions in the pseudorapidity range from 2.4 to 5.5 are shown. The average transverse energy per participant is found to be nearly independent of target mass. Estimates of nuclear stopping and of attained energy densities are made.

13177 (INIS-mf—10760) **Study of the behaviour of the Δ(3,3) resonance in nuclear matter by ($\pi,\pi'\gamma$) angular correlations on /sup 12/C(2/sup +/).** Olszewski, R. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Naturwissenschaftliche Fakultaet 1 - Mathematik und Physik). 24 Mar 1986. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751284/JAW.

The detailed study of the pion-nucleus scattering in the range of the Δ(3.3) resonance permits statements on the behaviour of a strong resonance in the surrounding nuclear medium and raises by this the question for the importance of subnuclear degrees of freedom in the nucleus. In the present thesis the pion-nucleus reaction mechanism was studied by means of pion-γ-angular correlation measurements on the /sup 12/C(2/sup +/, 4.4 MeV) state. The experiments were performed at the Swiss Institute for Nuclear Research. The scattered pions were detected by the SUSI spectrometer to which in coincidence six NaI detectors for the detection of the emitted γ-quanta were operated. For the momentum transfer q = 0.47 fm/sup -1/ and pion incident energies of 116, 140, 162, 180, and 226 MeV respectively for the momentum transfer q = 0.85 fm/sup -1/ and incident energies of 116, 162, and 226 MeV values of the angular correlation function for in the mean each 16 γ emission angles within and beyond the reaction plane were determined. The measurement results are compared with DWIA calculations in the static limit and in the Δ-hole model. In the static limit the transition is described starting from the free pion-nucleon process whereby the dynamics of the intermediate Δ-resonance are suppressed. The Δ-hole model yields an additional microscopical description for the propagation of the Δ-resonance. The static model cannot reproduce the energy slope of the correlation function for q = 0.47 fm/sup -1/ while the Δ-hole model achieves a very good agreement. The experiment shows by this that the description of the pion-nucleus scattering in the resonance range requires the regard of medium effects especially from the Δ propagation.

13178 (INIS-SU—431, pp 268) **Experimental study of the (p,pn) and (p,2p) reactions on /sup 7/Li nuclei.** Pasechnik, M.V.; Shostak, V.B.; Badovskij, V.P.; Palkin, G.P.; Likhachev, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13179 (INIS-SU—431, pp 269) **Detection of hydrogen superheavy isotopes in π/sup -/-meson absorption reaction by /sup 9/Be nuclei.** Gornov, M.G.; Morokhov, P.V.; Pechkurov, V.A.; Sergeev, F.M.; Khomutov, A.A.; Shafigullin, R.R. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13180 (INIS-SU—431, pp 270) **Alpha-particle absorption of stopped pions by /sup 9/Be nuclei.** Gornov, M.G.; Il'in, A.L.; Morokhov, P.V.; Pechkurov, V.A.; Smirnov, S.A.; Chernyshev, B.A.; Shishkov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13181 (INIS-SU—431, pp 286) **Measurement of excitation functions of 5-7,5 MeV proton elastic scattering by /sup 12/C and /sup 16/O nuclei.** Romanovskij, E.A.; Nguen Mak Kha; Khussejn Khamad Abbd. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13182 (INIS-SU—431, pp 298) **Investigation of decay of /sup 8/Be excited up to neutron binding energy.** Gledenov, Yu.M.; Zvarova, T.S.; Kvitek, I.; Mitrikov, M.P.; Mitrikova, R.S.; Popov, Yu.P.; Salatskij, V.I.; Fung Van Zuan. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13183 (INIS-SU—431, pp 300) **Investigation of the resonance structure in the /sup 10/Be (p,n) reactions at low energies.** Eremin, N.V.; Zajnalov, Sh.S.; Kabachenko, A.P.; Kamanin, D.V.; Medina, Kh.D.; Strizhov, V.F.; Ter-Akop'yan, G.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13184 (INIS-SU—431, pp 303) **Doorway state of /sup 13/C at excitation energy of 20 MeV.** Benetskij, B.A.; Klyachko, A.V.; Lifanov, M.N.; Plotnikova, M.V.; Radev, R.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13185 (INIS-SU—431, pp 393) **Searches for the tetraneutron in the /sup 7/Li + /sup 7/Li reaction.** Aleksandrov, D.V.; Glukhov, Yu.A.; Nikol'skij, E.Yu.; Novatskij, B.G.; Ogloblin, A.A.; Stepanov, D.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13186 (INIS-SU—431, pp 394) **Proton spectra from the three-particle /sup 6/B(O/sup +/) and /sup 6/Be(2/sup +/) decay.** Bochkarev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Chulkov, L.V.; Yan'kov, G.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13187 (INIS-SU—431, pp 403) **Polarization of /sup 12/B nuclei by inclined foils.** Aushev, V.E.; Zaika, N.I.; Magal', M.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13188 (INIS-SU—431, pp 329) **Manifestation of refraction effects in the /sup 13/C(/sup 6/Li,/sup 6/He)/sup 13/N reaction at /sup 6/Li energy of 93 MeV.** Goncharov, S.A.; Dem'yanova, A.S.; Lebedev, A.L.; Ogloblin, A.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13189 (INIS-SU—431, pp 331) **Mechanism of the /sup 7/Li(α,α't)/sup 4/He reaction proceeding over 4.63 MeV state of /sup 7/Li intermediate nucleus at E/sub α/=27.2 MeV.** Dmitrenko, V.N.; Kozyr', Yu.E.; Rudenko, B.A.; Sokolov, M.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13190 (INIS-SU—431, pp 340) **Limiting moments of α-cluster states of /sup 16/O/sup */ and /sup 20/Ne/sup */ nuclei.** Artemov, S.V.; Islamov, B.I.; Kadushkin, V.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13191 (INIS-SU—431, pp 344) **Analysis of the (d,t) reaction on /sup 7/Li, /sup 11/B and /sup 14/N nuclei at E/sub d/=18 MeV.** Gulamov, I.R.; Iskhakov, T.; Mukhamedzhanov, A.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13192 (INIS-SU—431, pp 345) **Measurement of relations between radiative and total widths of /sup 12/C unbound state decay.** Gorpinich, O.K.; Kadkin, E.P.; Kondrat'ev, S.N.; Rakitin, S.B.; Sklyarenko, V.D.; Tokareviskij, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13193 (INIS-SU—431, pp 346) **Measurement and analysis of the (/sup 3/He,α) reaction cross sections on /sup 9/Be, /sup 10,11/B, /sup 13/C, /sup 14/N and /sup 19/F nuclei at energy of 23 MeV.** Valiev, G.S.; Goncharov, S.A.; Gulamov, I.R. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13194 (INIS-SU—431, pp 347) **Investigation of the /sup 11/B(/sup 3/He,d)/sup 12/C reaction mechanism at E(/sup 3/He)=18 and 22 MeV.** Ignatenko, A.V.; Lebedev, V.M.; Orlova, N.V.; Spasskij, A.V.; Shakhvorostova, G.V.; Khoa, B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13195 (INIS-SU—431, pp 348) **Simple structure states with /sup 1C/ excited core.** Karadzhev, K.V.; Man'ko, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13196 (INIS-SU—431, pp 361) **/sup 12/C nucleus α decays in the (e,e'C) coincidence experiment, where C are charged particles.** Vojtsekhovskij, B.B.; Nikolenko, D.M.; Popov, S.G.; Rachek, I.A.; Toporkov, D.K.; Tsentalovich, E.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13197 (INIS-SU—431, pp 362) **Comparison of different proton channels of the decay of /sup 16/O excited in electron inelastic scattering.** Vojtsekhovskij, B.B.; Nikolenko, D.M.; Popov, S.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13198 (INIS-SU—431, pp 370) **Spectra of /sup 6/Li radiative transitions in photoproduction of neutral pions.** Naumenko, G.A.; Repenko, E.V.; Stibunov, V.N.; Tomchakov, V.K. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13199 (INIS-SU—431, pp 381) **Excitation of α particle in the /sup 7/Li(/sup 6/Li,/sup 9/Be)/sup 4/He reaction.** Glukhov, Yu.A.; Goryunov, O.Yu.; Koshchij, E.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13200 (INIS-SU—431, pp 382) **Observation of /sup 4/He nucleus excited states in the /sup 6/Li(/sup 7/Li,/sup 9/Be) reaction.** Glukhov, Yu.A.; Koshchij, E.I.; Mashkarov, Yu.G.; Nikol'skij, E.Yu.; Rudchik, A.T.; Sakuta, S.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13201 (INIS-SU—431, pp 384) **Production of /sup 6/He in collision of /sup 7/Li nuclei.** Bochkarev, O.V.; Korshenninikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Chulkov, L.V.; Yan'kov, G.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13202 (INIS-SU—431, pp 385) **Two-nucleon decay of 2/sup +/ states of /sup 6/He, /sup 6/Li, /sup 6/Be nuclei.** Bochkarev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Ogloblin, A.A.; Chulkov, L.V.; Yan'kov, G.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13203 (INIS-SU—431, pp 387) **Study on an interaction of nitrogen and carbon nuclei.** Vetoshkin, A.L.; Artemov, K.P.; Golovkov, M.S.; Gol'dberg, V.Z.; Pankratov, V.V.; Rudakov, V.P.; Serikov, I.N.; Timofeev, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13204 (INIS-SU—431, pp 389) **On the resonances in a region of high excitations of /sup 17/O, /sup 22/Na, /sup 24/Mg nuclei.** Shvedov, A.A.; Nemets, O.F.; Rudchik, A.T. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13205 (JINR-R—1-86-765) **Two-proton correlations in p-C, d-C, α-C and C-C interactions at 4.2 GeV/c per nucleon.** Armutlijski, D.; Bagdanovich, E.; Didenko, L.A. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701152/JAW.

Two-particle correlations between secondary protons from p-C, d-C, a-C and C-C collisions at 4.2 GeV/c per nucleon, emitted with small relative momenta, were studied. The correlations confranted to corresponding theoretical predictions provide an information about the radius of the proton emission region. From this method it is found that for fast (1/2p-vector/sub 1/+p-vector/sub 2/ $\geq$ 0.3 GeV/c) protons the radius of the proton emission region is of the magnitude as the radius of carbon target nucleus, for slow protons (1/2p-vector/sub 1/+p-ve ctor/sub 2/<0.3 GeV/c) the size of the emission region seems to be larger than that of the nucleus. Rms radius of the proton emission region decreases with an increase of proton momenta, and with increase of the transversal proton momenta as well. Rms radius of the proton emission region is not dependent on the kind of the incident nucleus. 10 refs.; 2 figs.; 5 tabs.

13206 (PCCF-T—86-07) **Study of the large components of impulsion in nuclei by means of inclusive electron scattering: "scaling" properties of the inclusive cross section.** Harradi, B. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire). Nov 1986. 135p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751428/JAW.

Numerous measurements of inclusive cross sections for the production of back-ward-angle energetic particles (protons, electrons) are obtained by diffusion of protons and electrons on the nucleons inside the nucleus. One can express these inclusive cross-section in term of the momentum distribution n(k) of nucleons inside the nucleus for values of k larger than 200 MeV/c. In the theoretical approach of Q.T.B.S. recently developed by GURVITZ (Optimal Approximation), which is based on the hypothesis of a single scattering mechanism nucleon-nucleon, an universal distribution n(k) arises for large impulsion of nucleons in the nucleus. The purpose of this work is the determination of this universal n(k) from experiments of inclusive (e, e') scattering in the low energy region of the quasi-elastic peak. The experiments were made A.L.S. for different angles ranging from 75/sup O/ to 145/sup O/ in a region of momentum transfer which had until than not been explored. A beam of 642 MeV electrons was used to bombard /sup 12/C and /sup 58/Ni. In the first point of this work, we describe the experimental setting and the methods which allow us to obtain cross-sections and to extract bore cross-sections by deconvolution of radiative corrections. In the second part, we compare the set of experimental data with the different existing theories. The description of the (e,e') diffusion in term of impulse approximation is not adequate, since the treatment of final state interaction (F.S.I.) and must therefore be analysed through GURVITZ's approach which introduces F.S.I. Impulsion distributions obtained from electrons at 642 MeV and protons at 200 MeV are identical. This justifies the hypothesis of a single interaction of the hadronic probe inside the nucleus.

13207 **Missing-energy dependence of the separated response functions for the /sup 12/C(e,e'p) reaction.** Ulmer, P.E.; Baghaei, H.; Bertozzi, W.; Blomqvist, K.I.; Finn, J.M.; Hyde-Wright, C.E.; Kalantar-Nayestanaki, N.; Kowalski, S.; Lourie, R.W.; Nelson, J. (Department of Physics and Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **59**: No. 20, 2259-2262(16 Nov 1987).

A longitudinal/transverse separation of the /sup 12/C(e,e'p) reaction in the quasielastic region has been performed in parallel kinematics. Above the two-particle emission threshold a broad bump is seen which has been attributed to knockout from the deeply bound s shell. The s-ahell region shows a large transverse enhancement compared to distorted-wave impulse-approximation calculations based on free-proton form factors. This enhancement increases with missing energy, indicating that a nonquasielastic reaction mechanism plays a significant role. The p shell is consistent with the free-proton behavior.

13208 **Reanalysis of tritium production in a sphere of ^{6}LiD irradiated by 14-MeV neutrons.** Fawcett, L.R. Jr. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **96**: No. 1-4, 239-242(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Tritium production in a sphere of ^{6}LiD irradiated by a central source of 140MeV neutrons reported by Hemmendinger et al. has been reanalyzed. The ^{6}LiD sphere consisted of 10 solid hemispherical shells nested with ampules of ^{6}LiH and ^{7}LiH located at 5.0, 7.7, 12.6, 20.0, and 30.0 cm from the center. The Los Alamos Monte Carlo neutron Photon Transport Code was used to calculate neutron transport through the ^{6}LiD and tritium production in the ampules. The model was three dimensional and employed ENDF/B-V cross sections.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

13209 (INIS-SU—431, pp 272) **M1-resonance structure in /sup 30/P nucleus.** Kachan, A.S.; Nemashkalo, B.A.; Storizhko, V.E. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13210 (INIS-SU—431, pp 304) **Spectrometric factors from the analysis of the (p,d) reaction on /sup 25/Mg and /sup 27/Al nuclei at E/sub p/=18,6 MeV.** Valiev, G.S.; Gulamov, I.R.; Denisov, Yu.I.; Iskhakov, T.; Mukhamedzhanov, A.M.; Ni, G.K.; Romanovskij, E.A.; Tipyasova, T.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13211 (INIS-SU—431, pp 305) **Proton elastic scattering on /sup 23/Na and /sup 35/Cl nuclei in the threshold range of analogue (p,n) channel.** Budan, O.; Chenzha, M.; Khatsegan, K. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13212 (INIS-SU—431, pp 398) **Measurement of duration of excited product decay of inelastic interaction of Ne + Ge nuclei.** Karamyan, S.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13213 (INIS-SU—431, pp 363) **(γ,xγ′) experiment for / sup 31/P.** Arzibekov, U.R.; Kapitonov, I.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13214 (INIS-SU—431, pp 390) **On a mechanism of the / sup 24/Mg(/sup 4/He,/sup 12/C)/sup 16/O reaction.** Shvedov, A.A.; Nemets, O.F. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13215 **Spin dependence of the coherent scattering lengths of ^{27}Al and admixture of s- and d- partial waves.** Mughabghab, S.F. (Brookhaven National Lab., Upton, NY, USA). *Radiation Effects;* **94**: No. 1-4, 297-302(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A long standing discrepancy between measurements and calculations of the sign of the incoherent scattering length is attributed to two sources: 1) spin dependence of the potential scattering radius and (2) identification of additional s-wave resonances at higher neutron energies. Detailed examination of the reaction ^{27}Al (n-vector,γ) ^{28}Al induced by thermal neutrons revealed that R/sub +/ - R-/sub -/0.32 +- 0.10 fm. Also shape fit analysis of the total cross section showed the presence of s-wave resonances at neutron energies 280, 386, 422, 491, 523, and 615 keV. One interesting outcome is the demonstration of the admixture of s- and d-wave partial waves in these resonances and the presence of a large d-wave neutron strength in the above energy region.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

13216 (CONF-871186—5) **Description of evaluations for /sup 54,56,57,58/Fe performed for ENDF/B-VI.** Larson, D.C.; Fu, C.Y.; Hetrick, D.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002532/JAW.

From Meeting on the international nuclear data library for fusion reactor technology; Vienna, Austria (16 Nov 1987).

Isotopic evaluations for /sub 54,56,57,58/Fe performed for ENDF/B-VI are briefly reviewed. The evaluations are based on analysis of experimental data and results of model calculations which reproduce the experimental data. Evaluated data are given for neutron induced reaction cross sections, angular and energy distributions, and for gamma-ray production cross sections associated with the reactions. File 6 formats are used to represent energy-angle correlated data and recoil spectra. Uncertainty files are included for the major cross sections. A detailed evaluation is given for ^{56}Fe and results of calculations for the major reactions are used for evaluations of the minor isotopes, with particular attention paid to inelastic scattering to the low-lying levels in ^{57}Fe.

13217 (ENEA-RT-TIB—85-38) **Evaluation of gamma ray production cross sections and spectra for neutron induced reactions on Chromium.** Mengani, A.; Fabbri, F.; Maino, G. (ENEA, Bologna, Italy. Dipt. Tecnologie Intersettoriali di Base). (ENEA, Rome (Italy)). 1985. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88701276/JAW.

An evaluation of photon production cross sections and relevant spectra is described, referring to neutron induced reactions on *H5*H0CR, *H5*H2CR, *H5*H4CR and sup(nat)CR in the energy range 100 KEV-8MEV. 30 refs; 18 tables; 13 figs.

13218 (INIS-SU—431, pp 262) **Vanadium K-auger spectrum from the /sub 24//sup 51/Cr decay.** Babenkov, M.I.; Zhdanov, V.S.; Starodubov, S.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13219 (INIS-SU—431, pp 283) **Analysis of double-differential cross sections of neutron inelastic scattering on vanadium nuclei.** Zhuravlev, B.V.; Isakov, A.G.; Lovchikova, G.N.; Pclyakov, A.V.; Rudenskaya, E.O.; Titarenko, N.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13220 (INIS-SU—431, pp 396) **Nonequilibrium mechanism of α-particle emission in the /sup 58/Ni + /sup 16/O reaction at E(/sup 16/O)=73 MeV.** Antropov, A.E.; Kudoyarov, M.F.; Pasternak, A.A.; Pugovkin, A.P.; Smirnov, A.V.; Chugunov, I.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13221 (INIS-SU—431, pp 400) **Yield of evaporated α particles in heavy ion reactions.** Volkov, V.V.; Ershov, S.N.; Ivanova, S.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13222 (INIS-SU—431, pp 352) **Fragmentation of α-particles with energies of 24 MeV per nucleon in interaction with /sup 58,64/Ni isotopes.** Vasil'ev, Yu.O.; Kiva, V.A.; Medvedev, V.I.; Pavlenko, Yu.N.; Pugach, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13223 (INIS-SU—431, pp 367) **Dipole giant resonance of nuclei with neutron number N=20.** Zhalilov, M.Kh.; Kapitonov, I.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13224 **^{58}Ni + n transmission, capture and differential elastic scattering data analysis in the resonance region.** Perey, C.M.; Perey, F.G.; Harvey, J.A.; Hill, N.W.; Macklin, R.L. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **96**: No. 1-4, 297-300(Mar 1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

High-resolution neutron transmission, capture and differential elastic scattering measurements have been made for ^{58}Ni-enriched targets at the Oak Ridge Electron Linear Accelerator (ORELA) from the eV to the MeV region. The three sets of data were analyzed simultaneously from 10 to 450 keV, and the transmission analysis was extended to 650 keV. For the 52 s-wave resonances observed between 10 and 650 keV, the average level spacing, and the strength function, are given.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

13225 (INIS-mf—10759) **Study of the neutron decay of isoscalar electric giant resonances in the nucleus /sup 90/Zr.** Muehldorfer, B. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Naturwissenschaftliche Fakultaet I - Mathematik und Physik). 3 Mar 1986. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751283/JAW.

The present thesis studies mainly the decay of the giant resonance region in /sup 90/Zr by means of a coincidence experiment which was performed at the /sup 6/Li beam of the Karlsruhe Isochronous Cyclotron. After excitation by inelastic scattering especially the neutron decay of the giant monopole and quadrupole resonance was observed by means of a (/sup 6/Li,/sup 6/Li'n) coincidence measurement. One aim of this experiment was to determine the relative branching ratios of the neutron decay from the region of the giant quadrupole resonance to the single low-lying states of /sup 89/Zr. In order to obtain an average over the angular correlation function for L>2 the decay neutrons were spectroscoped in 16 angles. The evaluation of the experiments yielded important results for the understanding of the giant resonances in heavy nuclei. The giant monopole and quadrupole resonances in /sup 90/Zr decay dominantly statistically. (orig./HSI).

13226 (INIS-SU—431, pp 276) **/sup 61/Cu proton resonance spins in the proton energy range of 2150-2455 keV.** Izosimov, I.N.; Kraft, O.E.; Parzhitskij, S.S.; Sigalov, V.M.; Sizov, I.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13227 (INIS-SU—431, pp 277) **Intermediate structure manifestation in /sup 61/Cu proton resonances.** Izosimov, I.N.; Kraft, O.E.; Parzhitskij, S.S.; Sigalov, V.M.; Sizov, I.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13228 (INIS-SU—431, pp 279) **Correlations of reduced probabilities B(E2) and B(M1) in the /sup 62/Ni(p,γ)/sup 63/Cu reaction.** Izosimov, I.N.; Sigalov, V.M.; Sizov, I.V.; Parzhitskij, S.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13229 (INIS-SU—431, pp 280) **Excitation of the /sup 60/Ni and /sup 94/Zr low-lying levels in the (n,n'γ) reaction.** Bazavov, D.A.; Golubova, A.A.; Kashuba, I.E.; Prikhod'ko, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13230 (INIS-SU—431, pp 287) **On the contribution of two-nucleon mechanism in the reaction of 60 MeV π/sup +/ meson absorption by Ag, Br nuclei.** Lantsev, I.A.; Lysenko, I.V.; Ostroumov, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13231 (INIS-SU—431, pp 288) **Peculiarities of (π,πd) reactions initiated by 170 MeV π/sup +/ and π/sup -/ mesons on Ag and Br nuclei.** Lantsev, I.A.; Ostroumov, V.I.; Pikhtov, S.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13232 (INIS-SU—431, pp 308) **Partial cross sections of the /sup 78/Se(p,γ)/sup 79/Br reaction.** Shebeko, K.V.; Kuptsov, G.N.; Nemashkalo, B.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13233 (INIS-SU—431, pp 310) **/sup 77/Br state excitation cross section in the (p,nγ) reaction.** Fedorets, I.D.; Zalyubovskij, I.I.; Nemashkalo, B.A.; Storizhko, V.E. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13234 (INIS-SU—431, pp 336) **Effect of orientation on the /sup 59/Co(α,2n)/sup 61/Cu reaction yield.** Zarifov, R.A.; Antsyferov, O.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13235 (INIS-SU—431, pp 338) **Investigation of the (/sup 3/He,/sup 3/He') and (/sup 3/He,α) reaction mechanisms at energy E(/sup 3/He)=60 MeV.** Burtebaev, N.T.; Dujsebaev, A.D.; Ivanov, G.N.; Kanashevich, V.I.; Sukharevskij, V.G.; Khajmin, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13236 (INIS-SU—431, pp 353) **Investigation of the (α, nx) reactions on zinc isotopes in the α-particle energy range of 14-24.4 MeV.** Abu Issa, N.N.; Khrisanfov, Yu.V.; Antropov, A.E.; Zarubin, P.P.; Smirnov, A.V.; Gusev, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13237 (INIS-SU—431, pp 354) **/sup 66/Zn(α, 2nγ)/sup 68/Ge reaction yield.** Begzhanov, R.B.; Gureev, E.S.; Islamov, T.; Khodzhaev, M.M.; Khuzhaev, S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13238 (INIS-SU—431, pp 355) **Study on the isotope-isotonic effect in total cross sections of reactions on nuclei with Z=50 and N=50.** Gorovenko, L.N.; Domnikov, V.N.; Dubar, L.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13239 (INIS-SU—431, pp 368) **On a structure of the / sup 88/Sr(γ,n)/sup 87m/Sr and /sup 168/Er(γ,n)/sup 167m/ Er reaction cross sections.** Bigan, Z.M.; Mazur, V.M.; Sokolyuk, I.V.; Goshovskij, M.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13240 (INIS-SU—431, pp 369) **Inelastic scattering of γ-quanta on strontium-87, barium-137 nuclei.** Bigan, Z.M.; Lomonosov, V.I.; Mazur, V.M.; Sokolyuk, I.V.; Trefilov, V.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13241 (INIS-SU—431, pp 375) **Isomer ratios of the /sup 76/Ge(γ,n)/sup 75m,g/Ge reaction yields in a region of giant dipole resonance.** Davydov, M.G.; Khamraev, F.Sh.; Shomurodov, Eh.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13242 (INIS-SU—431, pp 376) **Isomer ratios of the /sup 85/Rb(γ,n)/sup 84m,g/Rb reaction yields.** Davydov, M.G.; Khamraev, F.Sh.; Shomurodov, Eh.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13243 (JINR-R—7-87-255) **Possibility of obtaining information on emission mechanism for α-particles in the /sup 20/ Ne, /sup 40/Ar + Ge reactions using of the shadow effect.** Bugrov, V.N.; Epifanenkov, F.E.; Karamyan, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701173/JAW.

Monocrystal Ge targets are irradiated by /sup 20/Ne and / sup 40/Ar ions at the 5.5 MeV/nucleon energy for estimating the α-particle emission mechanism with using of the shadow effect. The method of α-particle registration by cellulose n itrate track detector is used. Shadow reflexes from crystallographic axes and planes with angular semi-width corresponding to theoretical estimates and with axial minimum yield chi of about 0.6 are observed. The measured values chi and Δ/sub chi/ are considered from the point of view of a possibility to extract the contribution of different α-particle emission sources such as a composite system, particle- and targetlike products of inelastic reaction. Different source contribution, reaction duration and blocking yield chi are simulated by calculations. 8 refs.; 2 figs.; 3 tabs.

13244 (KIYI—86-54) **Cross sections of /sup 87m/Sr and /sup 137m/Ba isomer production in (γ,γ′) and (γ,n) reactions.** Bigan, Z.M.; Mazur, V.M.; Sokolyuk, I.V. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701207/JAW.

Experimental cross sections of /sup 87m/Sr and /sup 137m/ Ba in (γ, γ′) and (γ, n) reactions were determined. The measurements were made at energy range of 4-18 MeV. At energy of 16 MeV the experimental estimates of isomer ration were obtained. The theoretical calculations were made after the statistical model. 14 refs.; 6 figs.; 1 tab.

13245 (OUP—87-31) **Particle-core multiplets in /sup 89/ Y.** Batsch, T.; Kownacki, J.; Zelazny, Z.; Guttormsen, M.; Ramsoey, T.; Rekstad, J. (Oslo Univ. (Norway). Fysisk Inst.). Oct 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751313/JAW.

The /sup 89/Y nucleus has been formed in its excited states via the /sup 87/Rb(α,2n) reaction at incident energies 24-34 MeV. The γ-ray decay of the states has been studied by measuring γ-γ-t coincidences, angular distributions and relative excitation functions. The experimental results from the present investigation are in general agreement with the former studies. However, some corrections in the level scheme have been introduced. Eight new levels with spins up to around 31/2 Planck constant have been observed. The uppermost levels have been arranged into a rotational-like sequence, suggesting a nuclear shape change. Using our and previously known data we have tried to locate and calculate the members of the 1g/sub 9/2/ x core multiplet. The present results are compared with the semi-empirical shell model and the particle-core weak coupling description. 27 refs.

13246 **Target residues from the interaction of copper with 35 MeV/nucleon /sup 12/C ions.** Cho, S.Y.; Chung, Y.H.; Porile, N.T.; Morrissey, D.J. (Department of Chemistry, Purdue University, West Lafayette, Indiana 47907). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2349-2358(Dec 1987).

Target residues from the interaction of copper with 35 MeV/nucleon /sup 12/C ions have been studied by off-line γ-ray spectroscopy. Cross sections, average forward ranges, and forward-to-backward ratios were measured for 35 products. The data were used to obtain the isobaric yield distribution, the mass yield distribution, and the longitudinal momentum transfer. The results are compared with other studies of the interaction of copper with intermediate-energy projectiles and with various models.

13247 **Shape changes and alignment properties in /sup 77/Kr.** Gross, C.J.; Cottle, P.D.; Headly, D.M.; Huettmeier, U.J.; Moore, E.F.; Tabor, S.L.; Nazarewicz, W. (Department of Physics, Florida State University, Tallahassee, Florida 32306). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2601-2610(Dec 1987).

Excited positive parity states up to spin ((41/2) have been studied in /sup 77/Kr using a 98 MeV /sup 28/Si beam on a natural chromium target. $\Delta J = 1$ transitions have been identified throughout the positive parity band. The energies, mixing ratios, and B(M1) transition rates for these transitions alternate in size as the spin increases. A cranked shell model analysis was performed along with Strutinsky-Bogolyubov cranking calculations. The observed decrease in the signature splitting of the νg/sub 9/2/ band has been attributed to a band crossing due to an aligning pair of g/ sub 9/2/ protons. Prolate quadrupole deformations of $\beta_2 = 0.34$ for the one-quasiparticle band and $\beta_2 = 0.26$ for the three-quasiparticle band are predicted. This band crossing is associated with a shape change caused by the polarization effect of aligned quasiparticles.

13248 **Angular momentum dependence of complex fragment emission.** Sobotka, L.G.; Sarantites, D.G.; Li, Z.; Dines, E.L.; Halbert, M.L.; Hensley, D.C.; Lisle, J.C.; Schmitt, R.P.; Majka, Z.; Nebbia, G. (Department of Chemistry, Washington University, St. Louis, Missouri 63130). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2713-2716(Dec 1987).

The angular momentum dependence of large fragment production in long-lived reactions is studied by measurements of fragment cross sections from reactions with substantially different angular momentum distributions and the coincident γ-ray multiplicity distributions. The results indicate that the primary l-wave distributions move to larger mean values and decrease in width and skewness with increasing mass symmetry in the decay channel. The results also confirm that the partition of angular momentum kinetic energy relaxed heavy-ion reactions is that expected for a rigidly rotating intermediate.

13249 **Direct evidence for two-neutrino double-beta decay in /sup 82/Se.** Elliott, S.R.; Hahn, A.A.; Moe, M.K. (Department of Physics, University of California, Irvine, California 92717). *Physical Review Letters;* **59**: No. 18, 2020-2023(2 Nov 1987).

The two-neutrino mode of double-beta decay in /sup 82/Se has been observed in a time-projection chamber at a half-life of (1.1/sub -0.3//sup +0.8/) x 10/sup 20/ yr (68% confidence level). This result from direct counting confirms the earlier geochemical

measurements and helps provide a standard by which to test the double-beta-decay matrix elements of nuclear theory. It is the rarest natural decay process ever observed directly in the laboratory.

13250 Angular momentum dependence of complex fragment emission. Sobotka, L.G.; Sarantites, D.G.; Li, Z.; Dines, E.L.; Halbert, M.L.; Hensley, D.C.; Schmitt, R.P.; Majka, Z.; Nebbia, G.; Griffin, H.C. (Washington Univ., St. Louis, MO, USA. Dept. of Chemistry; Oak Ridge National Lab., TN, USA; Texas A and M Univ., College Station, USA; Michigan Univ., Ann Arbor, USA). *Nuclear Physics [Section] A;* 471: No. 1/2, 131c-148c(7 Sep 1987). (CONF-8704188—). Contract AC02-85ER40210;AC02-76ER04052;AC05-84OR21400.

From Symposium on central collisions and fragmentation processes; Denver, CO, USA (7 Apr 1987).

Also published as report CONF-870410--19.

Large fragment (A>4) production at high angular momentum is studied via the reaction, 200 MeV /sup 45/Sc+/sup 65/Cu. Comparisons of the fragment yields from this reaction (high angular momentum) to those from /sup 93/Nb+Be (low angular momentum) are used to verify the strong angular momentum dependence of large fragment production predicted by equilibrium models. Details of the coincident γ-ray distributions not only confirms a rigidly rotating intermediate but also indicate that the widths of the primary L-wave distributions decrease with increasing symmetry in the decay channel. These data are used to test the asymmetry and L-wave dependence of emission barriers calculated from a rotating, finite range corrected, liquid drop model.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

13251 (EGG-M—29386) Further measurements of the delayed neutron spectra of $^{93-97}$Rb and $^{143-145}$Cs. Greenwood, R.C.; Caffrey, A.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1987. Contract AC07-76ID01570. 17p. (CONF-8709206—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE87009400/JAW.

From Specialists' meeting on delayed neutrons; Birmingham, UK (15 Sep 1987).

A further series of delayed-neutron energy spectral measurements for the fission product precursors $^{93-97}$Rb and $^{143-145}$Cs was made using the TRISTAN ISOL facility. The specific goal of these experiments was to improve the spectral definition for each of these isotopes both at the lower energies (below ~20 keV) and at the higher energies (above ~800 keV). To that end the following series of experiments was conducted: measurements using a H_3 gas-filled proportional counter (2.6 Atm. pressure) with pulse-shape discrimination (between beta/gammas and neutron) at a gain setting of 0.3 keV/channel, measurements using a CH_4 gas-filled proportional counter (5.3 Atm. pressure) at a gain setting of 8 keV/channel; and measurements using a 5.1-cm diameter x 1.27-cm thick BC-501 liquid scintillation detector with pulse-shape discrimination at a neutron gain setting of ~20 keV/channel. 9 refs., 11 tabs.

13252 (GSI—86-20) Nuclear structure studies on indium and tin isotope chains by means of laser spectroscopy. Eberz, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Mainz Univ. (Germany, F.R.)). Nov 1986. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751277/JAW.

In a collaboration with GSI in Darmstadt and ISOLDE in Geneva the hyperfine structure (HFS) and the isotope shift (IS) of the indium isotopes from /sup 104/In - /sup 127/In in their ground and isomeric states could be studied. Additionally the tin isotopes /sup 109/Sn and /sup 111/Sn could be measured. In tin the transition 5p/sup 2/ /sup 1/S/sub 0/ -> 5p6s /sup 3/P/sub 1/ with λ = 563 nm was studied. In indium the transition 5p /sup 2/P/sub 1/2/ -> 6s /sup 2/S/sub 1/2/ with λ = 410 nm and 5p /sup 2/P/sub 3/2/ -> 6s /sup 2/S/sub 1/2/ with λ = 451 nm could be measured. The magnetic dipole moments and electric quadrupole moments determined from the measurements of the HFS can be sufficiently explained in the framework of the single-particle model. From the moments the configurations and spins of the studied nuclear states can be stated. In /sup 109/Sn the nuclear spin was determined to I = 5/2. The measurement of the IS in two lines in /sup 108/In allowed regarding the coupling rules for nuclear moments the determination of the nuclear spin. The spin of the 40 m isomers of the /sup 108m/In can be stated to I = 2. The mean square nuclear charge radius exhibits a parabolic slope the quadratic part of which with a maximum in the shell center at N = 66 between the neutron numbers N = 50 and N = 82 can be understood as sum of contributions of a surface correlation, i.e. a quadrupole deformation as well as eventually present higher order terms or a change of the surface skin density. The deformation determinable by this description is both for tin and for indium essentially larger than the deformation from the B(E2) values of tin or from the intrinsic quadrupole moments in indium derived from the HFS. (orig./HSI).

13253 (GSI—87-49(prepr.)) Multiplicity and bombarding energy dependence of the entropy in relativistic heavy-ion reactions. Doss, K.G.R.; Hahn, D.; Poskanzer, A.M.; Ritter, H.G.; Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Schmidt, H.R.; Kampert, K.H.; Loehner, H. (Lawrence Berkeley Lab., CA, USA; Lund Univ., Sweden; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.; Muenster Univ., Germany, F.R.). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); Lund Univ. (Sweden); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.); Frankfurt Univ. (Germany, F.R.)). Aug 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751960/JAW.

The yield ratios of light clusters (d,t,/sup 3/He,α) to protons were measured with the Plastic Ball spectrometer for the reactions Nb+Nb and Au+Au for incident beam energies of 150, 250, 400 and 650 MeV/nucleon. The ratios are analyzed in the framework of the Quantum Statistical Model and the specific entropy is extracted as a function of the participant proton multiplicity. The results are compared with predictions of the fireball model and relativistic mean field calculations.

13254 (INIS-SU—431, pp 97) On the /sup 136/Nd (T/sub 1/2/=50.6 min) decay. Gromov, K.Ya.; Islamov, T.A.; Islamova, Kh.M.; Baratova, M.A.; Kalinnikov, V.G.; Kil'mukhammedov, M.K.; Kononenko, G.A.; Makhmud Abdililakh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13255 (INIS-SU—431, pp 103) Difference of charge radii for Sm and Gd nuclei with even and odd neutron numbers. Gangrskij, Yu.P.; Gradechni, Ch.; Zemlyanoj, S.T.; Iliev, S.; Marinova, K.P.; Markov, B.N.; Khoang Tkhi Kim Khueh; Chan Kong Tam. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13256 (INIS-SU—431, pp 105-106) /sup 147/Eu->/sup 147/Sm decay. Adam, I.; Dobesh, Ya.; Zhelev, Zh.T.; Zakoutski, D.; Kratsik, B.; Mikhajlova, M.; Penev, I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13257 (INIS-SU—431, pp 261) K-capture probability in the /sup 99/Rh and /sup 121/Te decay. Begzhanov, R.B.; Azimov, K.Sh.; Magrupov, R.D.; Mirakhmedov, Sh.A.; Mukhammadiev, A.; Narzikulov, M.; Salimov, S.Kh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13258 (INIS-SU—431, pp 281) /sup 90/Nb excitation spectrum in the /sup 90/Zr(p,n)/sup 90/Nb reaction at E/sub p/=22.5 MeV. Borzov, I.N.; Zhuravlev, B.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13259 (INIS-SU—431, pp 285) Gamma spectroscopy in Cd-111, Cd-113, Sn-117 neutron resonances nonconserving parity. Alfimenkov, V.P.; Borzakov, S.B.; Mareev, Yu.D.; Pikel'ner, L.B.; Khrykin, A.S.; Sharapov, Eh.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13260 (INIS-SU—431, pp 290) Isomer excitation cross sections in the /sup 99-102/Ru(p,n) reactions at E/sub p/=5-9 MeV. Skakun, E.A.; Batij, V.G.; Rakivnenko, Yu.N.; Rastrepin, O.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13261 (INIS-SU—431, pp 291) Study on the spin dependence of energy-level density for nuclei near closed proton shell with Z=50. Batij, V.G.; Skakun, E.A.; Rakivnenko, Yu.N.; Rastrepin, O.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13262 (INIS-SU—431, pp 293) Angular distribution and total cross sections of neutron scattering on even tellurium isotopes and their description in the framework of generalized optical model. Musaelyan, R.M.; Skorkin, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13263 (INIS-SU—431, pp 294) Neutron scattering on the first 2/sup +/ levels of tellurium isotopes and its description in the framework of generalized optical model. Musaelyan, R.M.; Skorkin, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13264 (INIS-SU—431, pp 311) Excitation function of long-lived radionuclide production of zirconium irradiation by protons, deuterons and alpha particles. Kuz'menko, V.A.; Lobach, Yu.N.; Prokopenko, V.S.; Sklyarenko, V.D.; Tokarevskij, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13265 (INIS-SU—431, pp 317) Search for /sup 124/Te compound state α-decay by means of induction telescope. Vtyurin, V.A.; Zhak, A.; Chadraabal, I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13266 (INIS-SU—431, pp 600) P-n multiplet states in light odd-odd In and Sb isotopes. Fenesh, T; Krasnakhorkai, A; Kibedi, T.; Timar, Ya.; Dombradi, Zh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13267 (INIS-SU—431, pp 337) Anomalies in threshold energies of some reactions. Zarifov, R.A.; Yakobi, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13268 (INIS-SU—431, pp 356) Investigation of nuclear structure of molybdenum even isotopes by α-particle inelastic scattering method. Kuterbekov, K.A.; Yushkov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13269 (INIS-SU—431, pp 358) Investigation of the /sup 127/I(d,p)/sup 128/I, /sup 129/I(d,t)/sup 128/I and /sup 129/I(d,p)/sup 130/I reactions. Ehgidi, T.; Khlavach, G.; Linder, Kh.; Kondurov, I.A.; Martynov, V.V.; Sakharov, S.L. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13270 (INIS-SU—431, pp 377) Isomer ratios of the /sup 112/Sn(γ,p)/sup 111m,g/In photoproduction reaction yields in a region of giant dipole resonance. Davydov, M.G.; Khamraev, F.Sh.; Shomurodov, Eh.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13271 (INIS-SU—431, pp 378-379) Photoyields pf long-lived residual nuclei from the separated tin isotopes. Arakelyan, A.A.; Balabekyan, A.R.; Danagulyan, A.S.; Khudaverdyan, A.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13272 (JINR-R—1-87-179) Multiplicity characteristics of particles emitted in π/sup -+/-Xe collisions at (2.34-9.0) GeV/c. Miller, K.; Pluta, J.; Pawlak, T.; Peryt, W.; Strugal'ski, Z. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of High Energy; Warsaw Univ., Poland). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701156/JAW.

Average multiplicities of particles emitted in π/sup +-/-Xe collisions at initial momenta (2.34-9.0) GeV/c were investigated. Events with intense proton emission were selected to analyse the behaviour of multiplicity characteristics depending on a collision parameter and initial momentum. Collisions with a small sighting parameter were compared with quasielemental collisions. Results obtained point out to that fact at 2.34 GeV/c initial momentum multiplicities of pions produced in more "central" and quasielemental collisions don't differ one from another. With growth of initial momentum a share of collisions with intense proton emission increases and intensity of produced pion emission enhances. Change of the nature of multiplicity distributions at 5.0 GeV/c initial momentum can testify to change of a collision mechanism of hadrons and nuclei in this range of momenta. 9 refs.; 5 figs.; 4 tabs.

13273 **(JINR-R—6-87-161) Study of the /sup 149/Nd oriented nucleus decay and of the structure of /sup 149/Pm (N=88).** Shimechek, P.; Prokhazka, I.; Finger, M. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701171/JAW.

Method of nuclear orientation at extra low temperatures was used to carry on the investigation into decay of /sup 149/Nd dissolved in gadolinium matrix. As a result of measurements experimental values of anisotropies for 27 gamma transitions in /sup 149/Pm have been determined. Analysis of data obtained permitted to measure spins of 288.2 and 425.3 levels as 9/2 and 7/2, correspondigly, and to confirm unambiguosly spins of several levels in daughter /sup 149/Pm using an independent method. Mixing coefficients have been determined for many gamma transitions, most of them - for the first time. Properties of /sup 149/Pm levels are discussed and comparison with calculations according to modern models of atomic nucleus is given. 21 refs.; 2 figs.; 2 tabs.

13274 **(KIYI—86-47) Investigation of the /sup 123/I decay.** Ageev, V.A.; Belyavenko, V.S.; Vishnevskij, I.N.; Zheltonozhskij, V.A.; Klyuchnikov, A.A. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701205/JAW.

A detailed investigation of decay scheme of /sup 123/I is made. A new information is obtained about the structure and the nature of excited states of /sup 123/Te, 12 new - transitions are detected, a new scheme of /sup 123/I decay is presented, where the presence of long-lived isomer /sup 123m/Te is shown with a half-life equal to 120 days. A total energy of decay is determined Q=1260 +- 7 keV. Based on /sup 123/I isotope an estimate of working life of pharmaceutical preparations is given. 6 res.; 2 figs.; 1 tab.

13275 **(KIYI—86-48) Investigation of decay schemes of /sup 94,96/Mo.** Belyavenko, V.S.; Vishnevskij, I.N.; Zheltonozhskij, V.A. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701206/JAW.

The level scheme of /sup 94,96/Mo were investigated from /sup 94/Tc and /sup 96/Nb decay. γ-ray and γ-γ-coincidence spectra and γ-γ-correlations were measured for some stages of γ-rays. The measurements were made by Ge-detectors. The parameters of mixing were determined for a number of γ-transitions in /sup 94,96/Mo. The spins of some excitation states in /sup 94/Mo were determined. The level schemes of /sup 94,96/Mo were essentially enlarged and supplemented. A comparison was made with a model of interactive bosons. 9 refs.; 2 figs.; 5 tabs.

13276 **Absolute gamma intensities in the A = 98 transitional nuclei and shape coexistence in /sup 98/Y.** Mach, H.; Gill, R.L. (Clark University, Worcester, Massachusetts 01610). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2721-2725(Dec 1987).

Absolute gamma intensities have been measured for the strong transitions in the decay chain ^{98}Rb→ ^{98}Sr→ ^{98}Y→ ^{98}Zr and ^{98}Nb→ ^{98}Mo and found approximately four times higher than those currently adopted. As a consequence, several contradictions in this crucial chain of nuclei are resolved. Shape coexistence is established in /sup 98/Y with a J/sup π/ = 1$^-$ "spherical" ground state and with a previously reported deformed band with band head at 495.7 keV.

13277 **Angular-distribution neutron-emission spectra of niobium following bombardment by fast neutrons.** Guenther, P.T.; Smith, A.B. (Argonne National Lab., IL, USA). *Radiation Effects;* **94**: No. 1-4, 281-284(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron-emission spectra at ten angles between 20 and 160 degrees and incident neutron energies of 5.9, 7.1 and 8.4 MeV were measured relative to the neutron field emitted after spontaneous fission of ^{252}Cf. The angular distribution of inelastically scattered neutrons appears to be essentially isotropic where it can be separated from the dominant elastic scattering peak. Above an excitation energy of 4 MeV the spectra are well described by a Maxwellian temperature distribution.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

13278 **(INIS-mf—10761) Spectroscopic studies of /sup 163/Hf, /sup 164/Hf, /sup 165/Hf, and /sup 166/Hf at high spin.** Blume, K.P. (Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 13 Oct 1986. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88751285/JAW.

The neutron-deficient atomic nuclei /sup 163/Hf, /sup 164/Hf, /sup 165/Hf, and /sup 166/Hf were studied gamma-spectroscopically at high angular momentum. They were produced in compound-nucleus reactions with a neon beam on samarium targets at the heavy ion accelerator VICKSI in Berlin. In the hitherto unknown isotopes /sup 163/Hf and /sup 165/Hf nuclear states up to the spin I 30Planck constant could be observed. In the level scheme for /sup 163/Hf three and for /sup 165/Hf eight rotational bands were established. Yrast levels up to the spin I = 34Planck constant were found for the nuclei /sup 164/Hf and /sup 166/Hf. (orig./HSI).

13279 (INIS-SU—431, pp 112) **Multipole composition of I/sub γ/->I/sub g/ transitions in the /sup 152/Eu and /sup 182/Ta decays.** Kartashov, V.M.; Oborovskij, A.I.; Troitskaya, A.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13280 (INIS-SU—431, pp 115) **Investigation of the /sup 152/Eu, /sup 154/Eu and /sup 156/Eu odd-odd nuclei.** Balodis, M.K.; Prokof'ev, P.T.; Tamberg, Yu.Ya.; Ehgidi, T.F. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13281 (INIS-SU—431, pp 116) **Electromagnetic moments and nuclear charge radii of holmium isotopes.** Alkhazov, G.D.; Barzakh, A.E.; Buyanov, N.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13282 (INIS-SU—431, pp 117-118) **/sup 156/Eu level structure.** Balodis, M.K.; Guseva, T.V.; Tamberg, Yu.Ya.; Afanas'ev, A.V.; Prokof'ev, P.T.; Kramer, N.D. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13283 (INIS-SU—431, pp 119) **On some properties of excited states of Ho nuclei with odd A=157-161.** Alikov, B.A.; Badalov, Kh.N.; Gambaatar, N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13284 (INIS-SU—431, pp 120-121) **K/sup π/=4/sup +/ band in /sup 160/Gd.** Berzin', Ya.Ya.; Grigor'ev, E.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13285 (INIS-SU—431, pp 122-123) **New bands and levels in /sup 160/Dy.** Grigor'ev, E.P.; Dadamukhamedov, T.R. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13286 (INIS-SU—431, pp 124-125) **/sup 163/Dy levels.** Kuvaga, I.L.; Bondarenko, V.A.; Kramer, N.D.; Nejburg, L.A.; Upitis, I.V.; Prokof'ev, P.T. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13287 (INIS-SU—431, pp 127-128) **Interaction of γ-vibrational and ground states in /sup 164/Er nucleus.** Gromov, K.Ya.; Islamov, T.A.; Baratova, M.A.; Usmanov, P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13288 (INIS-SU—431, pp 135) **On penetration effect in M1 component of 70.45 keV γ-transition in /sup 177/Ta.** Lashko, A.P.; Stril'chuk, N.V.; Feoktistov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13289 (INIS-SU—431, pp 136) **Study on the cascade γ-decay of /sup 178/Hf.** Bogdzel', A.A.; Boneva, S.T.; Vasil'eva, Eh.V.; Elizarov, O.I.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Yazvitskij, Yu.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13290 (INIS-SU—431, pp 137) **Investigation of the /sup 179/Hf excited states by means of two-quanta γ-cascades.** Boneva, S.T.; Vasil'eva, Eh.V.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Yazvitskij, Yu.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13291 (INIS-SU—431, pp 138) **Search for the 833keV γ-transition in the /sup 180m/Hf decay.** Kupryashkin, V.T.; Lashko, A.P.; Feoktistov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13292 (INIS-SU—431, pp 139) **Energies and intensities of γ-rays from the /sup 181/Hf decay.** Koshutskij, Yu.E.; Kupryashkin, V.T.; Lashko, A.P.; Feoktistov, A.I.; Shapovalova, I.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13293 (INIS-SU—431, pp 140) **Investigation of the /sup 181/Hf decay.** Bulgakov, V.V.; Gavrilyuk, V.I.; Kirishchuk, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13294 (INIS-SU—431, pp 141) **Determination of K conversion coefficients of 537keV γ-radiation in the /sup 184m/Re decay.** Bulgakov, V.V.; Gavrilyuk, V.I.; Kirishchuk, V.I.; Kupryashkin, V.T.; Lashko, A.P.; Muzalev, P.N.; Sidorenko, L.P.; Stril'chuk, N.V.; Feoktistov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13295 (INIS-SU—431, pp 267) **Two-quanta gamma cascade spectroscopy in neutron capture by deformed nuclei.** Popov, Yu.P.; Yazvitskij, Yu.S. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13296 (INIS-SU—431, pp 318) **Investigation of gamma cascades in neutron resonances of the /sup 163/Dy(n,γ) reaction.** Efimov, B.V.; Muradyan, G.V.; Prokof'eva, L.Yu.; Belyev, F.N.; Bolotskij, V.P.; Breslavskij, O.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13297 (INIS-SU—431, pp 359) **/sup 181/Ta nucleus fragmentation by relativistic deuterons.** Kozma, P.; Kliman, Ya.; Leonard, M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13298 (INIS-SU—431, pp 360) **/sup 184m,g/Re isomer excitation in (α,n) reaction.** Gavrilyuk, V.I.; Zheltonozhskij, V.A.; Kharlanov, V.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13299 (JINR-R—6-86-126) **Analysis of E1-transitions in odd-neutron nuclei of rare-earth elements. Influence of pairing correlations and Coriolis state mixing on E1-transitions in odd nuclei with N=99-103.** Alikov, B.A.; Muminov, T.M.; Sharonov, I.A.; Badalov, Kh. N.; Gromov, K.Ya. (Tashkentskij Gosudarstvennyj Univ., USSR; Samarkandskij Gosudarstvennyj Univ., USSR). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701166/JAW.

Submitted to the journal Izv. Akad. Nauk SSSR and to 36. conference on nuclear spectroscopy and nuclear structure, Kharkov, Apr 1986.

The reduced probabilities of E1-transitions of 5/2/sup -/[512] reversible 7/2/sup +/[633] type in odd-neutron nuclei with N=99-103 are analysed on the basis of nonadiabatic rotator model using wave functions and energies of single-particle states in axial-symmetric Woods-Saxon potential. Behaviour of reduced probabilities of the studied translations depending on neutrino number is explained mainly by coriolis interaction and pairing correlations of superfluid type. A good agreement with experiment has been obtained (delay factors of E1-transitions $F \leq 6$). Essential delay of 350.7 keV transition in /sup 173/Yb nucleus is explained. 26 refs.; 1 fig.; 6 tabs.

13300 (JINR-R—6-86-136) **Study on the neutrino properties in radioactive decay processes.** Vylov, Ts.; Gromov, K.Ya.; Pokrovskij, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701167/JAW.

Submitted to the 17. Session of the Galitskij V.M. All-union shcool on nuclear physics, 30 May - 8 Jun 1986.

The situation and perspectives of neutrino property investigations in radioactive decay processes are reviewed. The problem of taking into account the atomic level natural widths when constructing the apparatus response functions with internal conversion electrons in the tritium experiments are discussed. The results of the search for the ultralow energy K-captur branch to the 1187.1 keV level (/sup 158/Gd) in the decay /sup 158/Tb are presented. The experiment for the 2β/sub 0ν/-decay search by means of HPGe-detector telescope is suggested. The new experiment on the neutrino helicity measurement in the decay of /sup 152m/Eu with Ge(Li)-detector is described. 58 refs.

13301 **(JINR-R—6-87-73) Study on /sup 178/Hf cascade γ decay.** Bogdzel', A.A.; Boneva, S.T.; Vasil'eva, Eh.V. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701169/JAW.

Submitted to the journal Bull. Acad. Sci. USSR.

The transition energies and intensities of 166 two-quanta cascades that populate 8 low-lying levels of /sup 178/Hf compound nucleus are determined. In /sup 178/Hf level scheme 93 cascades are located. The scheme of /sup 178/Hf γ decay at E/sub f/ < 2.1 MeV energy is completed. Above 2.1 MeV the excitation energies and decay modes of 25 levels are determined. The comparison of experimental and calculated two-quanta cascade intensities in /sup 168/Er and /sup 178/Hf nuclei indicate the availability of non-statistical effects in cascade decay of these nuclei. 13 refs.; 3 figs.; 3 tabs.

13302 **(JINR-R—6-87-141) About /sup 164/Tm -> /sup 164/Er decay.** Adam, I.; Gons, Z.; Gromov, K.Ya.; Islamov, T.A.; Kononenko, G.A.; Kholmatov, A.Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701170/JAW.

Submitted to the journal Izv. AN SSSR, Ser. Fiz. and Organizing Committee of 37. Conference on nuclear spectroscopy and nuclear structure.

Spectra of internal conversion electrons, γ-rays and γ-γ-coincidences at the /sup 164/Tm decay (T/sub 1/2/=2 min) have been measured. New experimental results have been obtained. The decay scheme for /sup 164/Tm -> /sup 164/Er has been constructed. The ground, beta-, gamma- and octupole vibrational states of /sup 164/Er have been analysed. 41 refs.4 figs.; 3 tabs.

13303 **(KIYI—86-22) Study of the /sup 180/Hf(γ,γ')/sup 180m/Hf reaction within the energy range of 6-12 MeV.** Bigan, Z.M.; Mazur, V.M.; Sokolyuk, I.V. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1986. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701202/JAW.

The yields are measured and the cross sections of /sup 180/Hf (γ,γ') /sup 180m/Hf reaction are determined within the energy range of 6-12 MeV. The value is estimated of experimental isomer ratio at energyy of 7.25 MeV. The experimental results are compared with theoretical calculations according to statistical model of Fermi-gas. 13 refs.; 2 figs.

13304 **(KIYI—86-46) Determination of anomalies in internal conversion coefficients by methods of γ-spectroscopy.** Belyavenko, V.S.; Vishnevskij, I.N.; Zheltonozhskij, V.A. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1986. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701204/JAW.

New possibility are considered for the determination of anomalies in internal conversion coefficients by methods of angular gamma-correlations with unobservable intermediate cascade. The determination is made by penetration parameter λ by described method in /sup 169/Tm nucleus and a comparison of obtained results with known experimental data is made on λ for analogous transitions in deformed nuclei of /sup 161/Dy and /sup 175/Lu. The results are given on the determination of total international conversion coefficients for 8/sup -/ -> 8/sup +/ transitions of /sup 178,180/Hf using its γ-spectra. 11 refs.; 3 figs.

13305 **Nuclear data sheets for A = 183.** Firestone, R.B. (Lawrence Berkeley Laboratory, Berkeley, California 94720). *Nuclear Data Sheets;* **52**: No. 4, 715-788(Dec 1987). Contract AC03-76SF00098.

The 1975 evaluation of A = 183 has been revised using experimental decay and reaction data received by the date given below. copyright 1987 Academic Press, Inc.

13306 **Nuclear structure of light thallium isotopes as deduced from laser spectroscopy on a fast atom beam.** Bounds, J.A.; Bingham, C.R.; Carter, H.K.; Leander, G.A.; Mlekodaj, R.L.; Spejewski, E.H.; Fairbank W.M. Jr. (The University of Tennessee, Knoxville, Tennessee 37996). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2560-2568(Dec 1987).

The neutron-deficient isotopes /sup 189-194/Tl have been studied using collinear fast atom beam laser spectroscopy with mass-separated beams of 7 x 10^4 to 4 x 10^5 atoms per second. By laser excitation of the 535 nm atomic transitions of atoms in the beam, the $6s^27s\ ^2S$/sub 1/2/ and $6s^26p\ ^2P$/sub 3/2/ hyperfine structures were measured, as were the isotope shifts of the 535 nm transitions. From these, the magnetic dipole moments, spectroscopic quadrupole moments, and isotopic changes in mean-square charge radii were deduced. A large isomer shift in /sup 193/Tl was observed, implying a larger deformation in the $(9/2^-$ isomer than in the $(1/2^+$ ground state. The /sup 189,191,193/Tl/sup m/ isotopes have deformations that increase as the mass decreases. A deformed shell model calculation indicates that this increase in deformation can account for the drop in energy of the $(9/2^-$ bandhead in these isotopes. An increase in neutron pairing correlations, having opposite and compensating effects on the rotational moment of inertia, maintains the spacing of the levels in the $(9/2^-$ strong-coupled band. Results for /sup 194/Tl/sup m/ differ from previously published values, but are consistent with the /sup 190,192/Tl/sup m/ data.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

13307 **(CONF-8706232—1) Electro- and photonuclear physics with polarized beams and targets.** Holt, R.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003066/JAW.

From International symposium on modern developments in nuclear physics; Novosibirsk, USSR (27 Jun 1987).

Two long-standing issues in photonuclear physics, the giant M1 resonance in Pb and deuteron photodisintegration, have been studied recently with polarized photons at Urbana and Frascati, respectively. The implications that this work has for settling these key issues will be discussed. In addition, the advantages of the internal polarized target method for electron scattering studies will be discussed and the technology of internal polarized target development will be reviewed. The first results from a spin-exchange, optically-pumped polarized H and D source will be presented.

13308 (INIS-SU—431, pp 142) **Scheme of /sup 191/Ir levels excited in the (n,n'γ) reaction.** Prokof'ev, P.T.; Rezvaya, G.L.; Simonova, L.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13309 (INIS-SU—431, pp 143) **Structure of the /sup 192/Ir and /sup 194/Ir excited states.** Balodis, M.K.; Guseva, T.V.; Kern, Zh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13310 (INIS-SU—431, pp 144) **Investigation of /sup 193/Ir in the (n, n'γ) reaction.** Prokof'ev, P.T.; Rezvaya, G.L.; Simonova, L.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13311 (INIS-SU—431, pp 145) **Partial radiative width of the /sup 208/Pb 6190keV level.** Begzhanov, R.B.; Gladyshev, D.A.; Kobilov, O.Sh.; Kulabdullaev, G.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13312 (INIS-SU—431, pp 260) **Determination of X-radiation intensity in the /sup 198/Au decay.** Begzhanov, R.B.; Gladyshev, D.A.; Magrupov, R.D.; Mirakhmedov, Sh.A.; Narzikulov, M.; Abdulakhatov, P.A.; Salimov, S.Kh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13313 (INIS-SU—431, pp 284) **Nuclear level density from the neutron emission spectra in the (p,n) reaction on lead isotopes.** Biryukov, N.S.; Zhuravlev, B.V.; Rudenko, A.P.; Trykova, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13314 (INIS-SU—431, pp 295) **Investigation of product formation cross sections of Ir and U deep inelastic interactions and protons with E/sub p/=1GeV and peculiarities of reaction mechanism.** Belyaev, B.N.; Berezinskij, S.O.; Domkin, V.D.; Korobulin, Yu.G.; Mukhin, V.S.; Chigrinov, S.E. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13315 (INIS-SU—431, pp 401) **On search for the density isomers on multiple emission of delayed neutrons.** Avdeev, S.P.; Ganzorig, Zh.; Myshinskij, G.V.; Karnaukhov, V.A.; Kuznetsov, V.D.; Petrov, L.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13316 (INIS-SU—431, pp 435) **Populating of high spin metastable states in reactions with neutrons.** Bogila, E.A.; Kolomiets, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13317 **Fragment flow in nuclear collisions.** Doss, K.G.R.; Gustafsson, H.H.; Gutbrod, H.; Harris, J.W.; Jacak, B.V.; Kampert, K.; Kolb, B.; Poskanzer, A.M.; Ritter, H.H.; Schmidt, H.R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **59**: No. 24, 2720-2723(14 Dec 1987). Contract AC03-76SF00098.

The flow of light nuclei (Z = 1,2) and intermediate-mass nuclear fragments (3≦Z<10) is measured in collisions of 200-MeV/nucleon AU+Au over a large solid angle. An increase in the fragment-position and momentum-space alignment relative to the reaction plane is observed: The fragments exhibit stronger flow effects than light particles.

13318 **Nuclear data sheets for A = 218.** Ellis-Akovali, Y.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6371). *Nuclear Data Sheets;* **52**: No. 4, 789-809(Dec 1987). Contract AC05-84OR21400.

The available nuclear structure information for all nuclei with mass number A = 218 is presented. Various decay and reaction data are evaluated and compared. Adopted data, levels, spin and parities are given. copyright 1987 Academic Press, Inc.

13319 **Level spectrum of /sup 219/Ra and weak coupling in the light actinide region.** Cottle, P.D.; Gai, M.; Ennis, J.F.; Shriner J.F. Jr.; Bromley, D.A.; Beausang, C.W.; Hildingsson, L.; Piel W.F. Jr.; Fossan, D.B.; Olness, J.W. (A.W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2286-2296(Dec 1987).

We present a level spectrum for /sup 219/Ra derived from data on the reaction /sup 208/Pb(/sup 14/C,3n) studied at beam energies near the Coulomb barrier. Measurements of γ-ray excitation functions, γ-γ coincidences, γ-ray angular distributions, and electron conversion coefficients were made. The ground state band shows an alternating parity structure and is consistent with an interpretation in terms of a g/sub 9/2/ neutron weakly coupled to an even-even core. A nonyrast side band is observed and may arise from the anomalous coupling of a j/sub 15/2/ neutron to the core. The dependence of particle-core coupling behavior on the quadrupole deformation of the core and on the orbital in which the odd nucleon is located is discussed.

13320 **Formation of large target residues in intermediate energy nuclear collisions.** Loveland, W.; Xu, Z.; Casey, C.; Aleklett, K.; Sihver, L.; Seaborg, G.T. (Oregon State Univ., Corvallis, USA; Studsvik Energiteknik AB, Nykoeping, Sweden. Neutron Research Lab.; Lawrence Berkeley Lab., CA, USA). *Nuclear Physics [Section] A;* **471**: No. 1/2, 175c-190c(7 Sep 1987). (CONF-8704188—). Contract AC03-76SF00098;AM06-70RL02227.

From Symposium on central collisions and fragmentation processes; Denver, CO, USA (7 Apr 1987).

We have used radiochemical techniques to measure the yields, angular distributions and velocity spectra of the large (A/sub frag/ ≧ 2/3 A/sub tgt/) target residues from the fragmentation of /sup 197/Au by intermediate energy /sup 12/C, /sup 20/Ne, /sup 32/S, /sup 40/Ar, /sup 84/Kr and /sup 139/La projectiles. The fragment moving frame angular distributions are asymmetric for the lighter projectiles (C-Ar). The fragment velocity spectra are Maxwellian for the Kr induced reactions and non-Maxwellian for the reactions induced by the lighter ions. We interpret these results in terms of a change in the dominant fragment production mechanism(s) from one(s) involving a fast non-equilibrium process for the lighter ions to a slow, equilibrium process for Kr. Comparison of the measured yields and angular distributions with calculations made using a Boltzmann transport equation with appropriate modifications for Pauli blocking, etc. show excellent agreemnt between data and theory.

13321 **318 and 800 MeV (p,xn) cross sections.** Meier, M.M.; Holtkamp, D.B.; Morgan, G.L.; Robinson, H.; Russell, G.J.; Whitaker, E.R.; Amian, W.; Paul, N. (Los Alamos National Lab., NM, USA; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Reaktorentwicklung). *Radiation Effects;* **96**: No. 1-4, 73-76(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron yields from proton bombardment of elemental Pb and depleted U have been measured at bombarding energies of 318 and 800 MeV. Additionally, at 800 MeV, data were obtained for Al and C. The data were obtained at two different angles/flight-paths and were collected in two parameter histograms of time-of-flight and pulse-height in order to select detector biases in the analysis and to permit comparison of calculated and experimental pulse height spectra in the calculation of detector efficiency. The data have been reduced to absolute double-differential cross sections and

are in good agreement with INC calculations at 800 MeV but exceed calculation by a factor of three at the lower energy.

13322 **Low energy antiproton nucleus interactions.** Sainio, M.E.; Ashford, V.; Sakitt, M.; Skelly, J.; Debbe, R.; Fickinger, W.; Marino, R.; Robinson, D.K. (Brookhaven National Laboratory, Upton, New York 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 663-665(15 Nov 1984). (CONF-8405193—). Contract AC02-76CH00016.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We have studied antiproton quasielastic scattering on Al, Cu, and Pb for two incident momenta, 514 and 633 MeV/c. Combining these data with other existing p-bar nucleus data, we have performed a global analysis using a nonrelativistic optical potential of the Woods-Saxon form.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

13323 (INIS-SU—431, pp 146) **Determination of /sup 226/Fr β-decay energy.** Veselov, G.V.; Mezilev, K.A.; Novikov, Yu.N.; Popov, A.V.; Sergienko, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13324 (INIS-SU—431, pp 256) **Effect of internal conversion on formation of fission product electronic structure.** Kogan, V.I.; Majdikov, V.Z.; Pikul', V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13325 (INIS-SU—431, pp 296) **Approximation of independent yields of uranium fission products by protons with E/sub p/=1GeV (on the base of study of fragment isotope distribution).** Belyaev, B.N.; Berezinskij, S.O.; Domkin, V.D. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13326 (INIS-SU—431, pp 320) **Absolute cross section of the U(n,/sup 8/Be) reaction.** Rutkevich, N.Ya.; Golovnya, V.Ya.; Olejnik, S.N.; Sheptulenko, E.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13327 (INIS-SU—431, pp 556) **Evaluating the values of characteristics of decay and radiations for transuranium radionuclides.** Chechev, V.P.; Kuz'menko, N.K.; Sergeev, V.O. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13328 (INIS-SU—431, pp 333) **Experiments on search for neutron clusters.** Ageev, V.A.; Vishnevskij, I.N.; Gavrilyuk, V.I.; Zheltonozhskij, V.A.; Lashko, T.N.; Stril'chuk, N.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13329 (INIS-SU—431, pp 342) **Duration of the neptunium isotope excited state decay.** Grusha, O.V.; Melikov, Yu.V.; Platonov, S.Yu.; Tulinov, A.F.; Yuminov, O.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13330 (INIS-SU—431, pp 380) **Measurement of cross sections of /sup 243/Am prompt and delayed fission induced by 450-950 MeV electrons.** Evseev, I.G.; Ivanov, D.I.; Nedorezov, V.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13331 **Yield and recoil properties of iodine isotopes from the interaction of 240 MeV /sup 12/C with /sup 238/U.** Yu, Y.W.; Lee, C.H.; Moody, K.J.; Kudo, H.; Lee, D.; Seaborg, G.T. (College of Nuclear Science, National Tsing-Hua University, Taiwan, Republic of China). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2396-2402(Dec 1987).

The independent yields, recoil properties, and forward-to-backward ratios (F/B) of iodine isotopes from the interaction of 240 MeV /sup 12/C with /sup 238/U have been measured radiochemically by the thick-target/thick-catcher method. The isotopic yield distribution curve has been constructed and is found to consist of two overlapping Gaussians, peaking at A = 126.5 and 133.8 with width parameters of 2.29 and 2.04 mass units, respectively. All the measured iodine isotopes had ranges of 7.7 +- 0.4 mg/cm^2. The neutron-deficient products have F/B of 1.76 +- 0.14, but the neutron-excessive products have F/B of only 1.09 +- 0.06. The yield curve was analyzed with the liquid drop model and the recoil curve was analyzed by the standard two-step vector model; the results show that the neutron-deficient products are formed from nonequilibrium processes and the neutron-excessive products are formed from the normal low-energy fission process.

13332 **Search for heavy-ion radioactivity from /sup 241/Am.** Moody, K.J.; Hulet, E.K.; Wang, S.; Price, P.B.; Barwick, S.W. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2710-2712(Dec 1987).

Using phosphate glass detectors capable of withstanding a background dose of ~10/sup 14/ alpha particles per cm^2, we have searched for rare decay modes of /sup 241/Am involving emission of energetic heavy ions. Predictions of the branching ratio for /sup 34/Si emission relative to alpha decay of /sup 241/Am range from 4 x 10/sup -13/ to 4 x 10/sup -16/. In a six-month exposure to 8 mg of /sup 241/Am, with detectors subtending a solid angle of 2.51 sr, we detected no particles with $12 \leq Z \leq 16$, from which we infer an upper limit (2σ) of 7.4 x 10/sup -16/.

13333 **Radioactive decay of /sup 234/U via Ne and Mg emission.** Wang, S.; Price, P.B.; Barwick, S.W.; Moody, K.J.; Hulet, E.K. (Physics Department, University of California, Berkeley, California 94720). *Physical Review [Section] C: Nuclear Physics;* **36**: No. 6, 2717-2720(Dec 1987).

We have identified three modes of radioactive decay of /sup 234/U by barrier penetration (in addition to alpha decay): emission of a Ne ion, emission of a Mg ion, and spontaneous fission. Lifetimes are (3.7 +- /sup 1.2//sub 0.9/) x 10^{17}, (1.1 +- /sup 1.3//sub 0.6/) x 10^{18}, and (1.9 +- 0.1) x 10^{16} yr respectively. This is the first example of a nuclide with four hadronic decay modes.

13334 **Level structure of /sup 225/Ac.** Ahmad, I.; Gindler, J.E.; Friedman, A.M.; Chasman, R.R.; Ishii, T. (Argonne National Lab., IL, USA). *Nuclear Physics [Section] A;* **472**: No. 2, 285-294(28 Sep 1987). Contract W-31-109-ENG-38.

The level scheme of /sup 225/Ac has been deduced from the study of the α-decay of /sup 229/Pa and β/sup -/decay of /sup

225/Ra. Sources of /sup 229/Pa were produced by the /sup 229/Th(d,2n) and /sup 230/Th(d,3n) reactions, and the /sup 225/Ra activity was obtained by milking a /sup 229/Th sample. Gamma singles spectra of /sup 229/Pa and /sup 225/Ra were measured with high-resolution Ge detectors placed in a very low background shield. Alpha-gamma and $\gamma\gamma$-coincidence measurements were made with /sup 229/Pa sources. Using the ratio of the KX-ray and γ-ray intensities obtained from gated γ-ray spectra, we were able to deduce K conversion coefficients of the 115.55 and 120.80 keV transitions which gave M1 multipolarities for these transitions. Four bands were identified: Kπ = 3/sup -//2, ground; 3/sup +//2, 40.09 keV; 5/sup -//2, 120.80 keV; and 5/sup +//2, 155.65 keV. The half-life and alpha branching ratio, $\alpha/(\alpha + EC)$, were measured to be 1.50 +- 0.05 d, and (0.48 +- 0.05)%, respectively.

13335 **R-matrix analysis of the ^{239}Pu neutron cross sections.** Saussure, G. de; Perez, R.B.; Macklin, R.L. (Oak Ridge National Lab., TN, USA; Tennessee Univ., Knoxville, USA). *Radiation Effects;* **96**: No. 1-4, 293-296(Mar 1986). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

^{239}Pu neutron cross-section data in the resolved resonance region were analyzed with the R-Matrix Bayesian Program SAMMY. Below 30 eV the cross sections computed with the multilevel parameters are consistent with recent fission and transmission measurements as well as with older capture and alpha measurements. Above 30 eV no suitable transmission data were available and only fission cross-section measurements were analyzed. However, since the analysis conserves the complete covariance matrix, the analysis can be updated by the Bayes method as transmission measurements become available. To date, the analysis of the fission measurements has been completed up to 300 eV.

13336 **Measurement of the neutron spectra from the decay of the giant quadrupole resonance in ^{238}U.** Countryman, P.J.; Griffioen, K.A.; Oremland, N.Z.; Van Bibber, K.; Yearian, M.R.; Calarco, J.R.; Woodworth, J.G. (Stanford Univ., CA, USA. Dept. of Physics; Stanford Univ., CA, USA. High-Energy Physics Lab.; New Hampshire Univ., Durham, USA. Dept. of Physics; Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* **92**: No. 1-4, 295-300(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The coincidence experiments $(\alpha,\alpha'f)$ and $(\alpha,\alpha'nf)$ on ^{238}U have been performed for a beam energy Esub(α)=120 MeV and for α-scattering angles thetasub(α')=9°,15°, and 17°. The 9° and 17° data correspond to maxima in the angular distribution for the isoscalar giant quadrupole resonance, whereas the 15° data lie close to a minimum. Using a set of fission counters which covered roughly 80% of 4π, neutrons associated with fission in the $(\alpha,\alpha'n)$ spectrum were rejected. A first look at these spectra is presented.

13337 **Intermediate structure in the fission cross sections of the even curium isotopes.** Block, R.C.; Harris, D.R.; Maguire, H.T. Jr.; Stopa, C.R.S.; Slovacek, R.E.; Dabbs, J.W.T.; Dougan, R.J.; Hoff, R.W.; Lougheed, R.W. (Rensselaer Polytechnic Inst., Troy, NY, USA; Westinghouse Electric Corp., Pittsburgh, PA, USA; Centro Tecnico Aeroespacial, Sao Jose dos Campos, Brazil. Inst. de Estudos Avancados; Knolls Atomic Power Lab., Schenectady, NY, USA; Oak Ridge National Lab., TN, USA; Lawrence Livermore National Lab., CA, USA). *Radiation Effects;* **92**: No. 1-4, 305-310(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The neutron-induced fission cross sections of Cm-244, Cm-246, and Cm-248 which were measured with a lead spectrometer system at Rensselaer have been analyzed for intermediate structure. Gross structure is observed in Cm-244 near 200, 400, 800, and 2000 eV and in Cm-246 near 350, 800, and 3300 eV. For Cm-248 a very broad type of structure is observed near 10 keV. Assuming double-barrier fission, the Cm-244 and Cm-246 structure is consistent with the outer potential well lying 2 to 3 MeV above the inner potential well. The broad structure observed in Cm-248 fission implies significantly different barrier parameters than for Cm-244 or Cm-246.

13338 **First results for 960 A.MeV /sup 238/U on /sup 238/U in the LBL streamer chamber.** Fung, S.H.; Beavis, D.; Gorn, W.; Keane, D.; Liu, Y.H.; Poe, R.T.; VanDalen, G.; Vient, M. (University of California, Riverside, CA 92521). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 750-754(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We report preliminary results for uranium on uranium collisions at the LBL streamer chamber facility, at the maximum Bevalac incident energy. Global event parameters are compared with results for Ar on KCl in the same energy region, and with intranuclear cascade model predictions. We also report results of temperature fits to negative pion spectra.

13339 **Two- and three-pion correlations in Ar on Pb_3O_4 collisions.** Fung, S.Y.; Beavis, D.; Chu, S.Y.; Keane, D.; Liu, Y.M.; Poe, R.T.; VanDalen, G.; Vient, M. (University of California, Riverside, CA 92521). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 755-758(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The technique of pion interferometry is used to study the pion source for central collisions of 1.8 GeV/nucleon Ar on Pb_3O_4. Both two and three pion correlations are presented.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 12274, 13005, 13041, 13045, 13046, 13067, 13085, 13087, 13088, 13154, 13155, 13162, 13206, 13250, 13768

13340 **(AAEC/E—645) Guide to the AUS modular neutronics code system.** Robinson, G.S. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1987. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700780/JAW.

A general description is given of the AUS modular neutronica code system, which may be used for calculations of a very wide range of fission reactors, fusion blankets and other neutron applications. The present system has cross-section libraries derived from ENDF/B-IV and includes modules which provide for lattice calculations, one-dimensional transport calculations, and one, two, and three-dimensional diffusion calculations, burnup calculations and the flexible editing of results. Details of all system aspects of AUS are provided but the major individual modules are only outlined. Sufficient information is given to enable other modules to be added to the system.

13341 **(CONF-8709200—2) Heavy ion excitation of giant resonances: The next generation.** Bertrand, F.E.; Beene, J.R.; Horen, D.J. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003283/JAW.

From 1. topical meeting on giant resonance excitation in heavy-ion collisions; Legnaro, Italy (21 Sep 1987).

The prospects for high energy heavy ion excitation of giant resonances are discussed. A brief review is provided of the results obtained to date using low/medium energy heavy ions and it is suggested that those results show no substantial advantage of heavy ions for giant resonance excitation. Calculations are presented that show that Coulomb excitation becomes the dominant excitation mechanism of the giant resonances for heavy ions above about 100 MeV/nucleon. The Coulomb excitation provides extremely large differential cross sections for excitation of both isovector and isoscalar resonances. Recent data are presented for inelastic scattering of 84 MeV/nucleon ^{17}O ions on ^{208}Pb that demonstrate the effectiveness of Coulomb excitation in providing extremely large cross sections and peak-to-continuum ratios for the isoscalar giant quadrupole resonance and the isovector giant dipole resonance. 19 refs., 17 figs.

13342 (CONF-8710231—1) **Selected topics in nuclear and atomics physics.** Raman, S. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003289/JAW.

From 8. international school on nuclear physics, neutron physics and nuclear energy; Varna, Bulgaria (19 Oct 1987).

Three topics of current interest are briefly discussed: direct radiative capture of slow neutrons, global systematics of $B(E2;0_1^+ \rightarrow 2_1^+)$ values, and advances in the study of heavy-ion-induced x-ray satellite emission. An interested reader is provided with a list of recent references on the above topics. 14 refs., 3 figs.

13343 (ENEA-RT-TIB—86-3) **Gamma ray absorption and scattering in transitional regions of the interacting boson model.** Maino, G.; Ventura, A.; Zuffi, L.; Van Isacker, P. (ENEA, Rome (Italy)). 1986. 14p. (CONF-8506120—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88700793/JAW.

From 4. international conference on nuclear reaction mechanisms; Varenna, Italy (10 Jun 1985).

The present work describes, in the frame of the interacting boson model, the processes of absorption, elastic and inelastic scattering of 8-20 MeV photons from even Meodymium and Osmium isotopes, corresponding to the U(5)yieldsSU(3)??? an and SU(3)yieldsO(6) transitional regions of the model.

13344 (FEI—1685) **Characteristics of random force in the phenomenological description of surface oscillations of heated spherical nuclei.** Svin'in, I.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1985. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701005/JAW.

Choice of statistic characteristics of random force in the description of surface oscillations of heated spherical nuclei in the approximation of Brownian movement is discussed. Phenomenological and microscopic approaches to the given phenomenon description are compared which permits to obtained the model evaluation of the random force correlation function. 8 refs.

13345 (INIS-mf—11103) **Preequilibrium emission of protons and isotopic effect in the fast neutron-induced (n,p) reactions on heavy elements.** Hien, P.Z.; Lien, H.N. (National Inst. for Atomic Energy, Ho Chi Minh City (Vietnam)). [1987]. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701086/JAW.

The 14 Mev neutron-induced (n,p) reaction cross-sections for the isotopes of Sm, Dy and Er have been calculated using the preequilibrium exiton + compound nucleus evaporation models. For a given element, as the neutron number of the isotopes increases, the (n,p) reaction cross-section decreases exponentially with the reaction Q-value corrected for the pairing energy of the residual nucleus. More than 85% of the preequilibrium protons are emitted from the exiton state n=3. Base on this result an analytical formula has been found for calculations of the (n,p) reaction cross-sections of the heavy isotopes.

13346 (INIS-SU—431, pp 99-100) **Energy level schemes and binding energies for nuclei in the region of $140<A<200$ according to simplified model of strongly limited dynamics.** Sabalyauskas, L.Yu.; Vanagas, V.V.; Guseva, T.V.; Ruzha, Ya.Kh.; Tamberg, Yu.Ya. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13347 (INIS-SU—431, pp 101) **Energy systematics of the K/sup π/=0/sup +/ levels in rare earth region.** Grigor'ev, E.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13348 (INIS-SU—431, pp 102) **Calculations of primary gamma-transition probabilities from the /sup 145/Nd(n,γ) reaction with averaging over resonances.** Voronov, V.V.; Knat'ko, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13349 (INIS-SU—431, pp 104) **Low-energy excitations in Eu odd nuclei.** Adam, I.; Zakoutski, D.; Zhelev, Zh.T.; Mikhajlova, M.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13350 (INIS-SU—431, pp 107-108) **Analysis of the E2-, M1-transition mixing in odd-neutron rare earth nuclei in the framework of the nonadiabatic rotational model.** Alikov, B.A.; Baratova, M.A.; Gromov, K.Ya.; Muminov, T.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13351 (INIS-SU—431, pp 109-110) **Analysis of th E2-, M1-transition mixing in odd-proton rare earth nuclei in the framework of the nonadiabatic rotational model.** Alikov, B.A.; Baratova, M.A.; Gromov, K.Ya.; Muminov, T.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13352 (INIS-SU—431, pp 126) **Does self-consistent phonon model possess the prediction force.** Barts, B.I.; Zalyubovskij, I.I.; Inopin, E.V.; Kazarinov, M.I.; Kuznichenko, A.V.; Shlyakhov, N.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13353 (INIS-SU—431, pp 129-130) **/sup 168/Er energy levels in self-consistent phonon model.** Barts, B.I.; Zalyubovskij, I.I.; Inopin, E.V.; Kazarinov, M.I.; Kuznichenko, A.V.; Shlyakhov, N.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13354 (INIS-SU—431, pp 131-132) **/sup 169/Yb nonrotational state structure with allowance for Pauli principle.** Bonch-Osmolovskij, N.A.; Morozov, V.A.; Khudajberdiev, Eh.N. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13355 (INIS-SU—431, pp 134) **On the transitions between the 7/2/sup +/[633] and 5/2/sup -/[512] bands in /sup 173/Yb.** Dzhelepov, B.S.; Lyutorovich, N.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13356 (INIS-SU—431, pp 150) **On the N-N interaction properties admitting three-neutron bound state.** Zatekin, V.V.; Komarov, V.V.; Popova, A.M.; Shabalina, E.K. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13357 (INIS-SU—431, pp 151) **Six-nucleon system as a theoretical nuclear laboratory.** Kukulin, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13358 (INIS-SU—431, pp 152) **Self-consistent distribution of nucleon density in nuclei with allowance for shell effects.** Okhrimenko, N.P.; Simenog, I.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13359 (INIS-SU—431, pp 153) **On hexadecapole force (Y/sub 42/) effect on γ-vibrational states of rare earth nucleus region.** Nesterenko, V.O.; Sushkov, A.V.; Solov'ev, V.G. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13360 (INIS-SU—431, pp 154) **Strength function of /sup 208/Pb M1-excitations in a model with 2p2h configuration account.** Tselyaev, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

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13417 (INIS-SU—431, pp 439) **Fine structure of /sup 14/C nuclei arising in the /sup 223/Ra spontaneous decay.** Bugrov, V.P.; Kadmenskij, S.G.; Furman, V.I.; Chuvil'skij, Yu.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

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13419 (INIS-SU—431, pp 351) **Analysis of deuteron inclusive spectra from helium-3 ion breakup reaction on complex nuclei at energy of 130 MeV.** Evlanov, M.V.; Sokolov, A.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

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13420 (INIS-SU—431, pp 371) **Photodisintegration of / sup 6/Li in the energy range up to 50 MeV: analysis of partial channel cross sections.** Varlamov, V.V.; Surgutanov, V.V.; Chernyaev, A.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

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13421 (INIS-SU—431, pp 372-373) **Semidirect proton decay of giant resonance of non-self-conjugate magnesium isotopes.** Irgashev, K.M.; Kapitonov, I.M.; Piskarev, I.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

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13422 (INIS-SU—431, pp 388) **On angular correlations in the /sup 12/C(/sup 6/Li,d)/sup 16/O(α)/sup 12/C reaction.** Golovkov, M.S.; Gol'dberg, V.Z. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13423 (INIS-SU—431, pp 364) **Semidirect components of partial and total photonucleon cross sections of /sup 31/P.** Arzibekov, U.R.; Ishkhanov, B.S.; Kapitonov, I.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13424 (INP—1245/PL) **Separation of diffractive and refractive effects in nuclear elastic scattering.** Wojciechowski, H. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701346/JAW.

The elastic scattering amplitudes for charged and neutral particles have been reduced to the simplest forms better for physical interpretations. Using these simplest forms the scattering amplitudes are next decomposed into refractive plus reflective and diffractive parts. This was used to calculate the diffractive and refractive elastic cross sections. The simplest form of the elastic scattering amplitude for charged particles was used to derive the basic equation for the sum-of-differences (SOD) method of determination of the total reaction cross section.

13425 (INP—1249/PL) **Velocity distribution of residual nuclei after sequential nucleon evaporation.** Gorski, A.; Srokowski, T. (Institute of Nuclear Physics, Krakow (Poland)). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701349/JAW.

A simple formula for the velocity distribution of nuclei after sequential nucleon evaporation from a compound nucleus is derived. The Gaussian distribution for a single act of nucleon emission was assumed. Results are compared with experimental data.

13426 **(INP—1255/PH) On distributions of antibaryons in p-bar-nucleus inelastic collisions.** Jezabek, M.; Rozanska, M.; Karczmarczuk, J. (Institute of Nuclear Physics, Krakow, Poland; Uniwersytet Jagiellonski, Krakow, Poland. Inst. Fizyki). (Institute of Nuclear Physics, Krakow (Poland)). 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701351/JAW.

In the framework of the dual parton model we calculate the spectra of secondary antibaryons in p-bar-nucleus non-annihilation inelastic interactions. We find that the number of antibaryons in the backward hemisphere in the p-bar-nucleon centre-of-mass frame can grow with the atomic number of the nucleus.

13427 **(INP—1264/PL) Symmetric splitting of very light systems in the coalescence and reseparation model.** Blocki, J.; Grotowski, K.; Planeta, R.; Swiate cki, W.J. (Uniwersytet Jagiellonski, Krakow, Poland. Inst. Fizyki; Institute of Nuclear Physics, Krakow, Poland; California Univ., Berkeley, USA. Lawrence Berkeley Lab.). (Institute of Nuclear Physics, Krakow (Poland)). 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701358/JAW.

The coalescence and reseparation model has been used to calculate trajectories of the /sup 12/C + /sup 40/Ca, /sup 9/Be + /sup 40/Ca and /sup 6/Li + /sup 40/Ca collisions which lead to the symmetric splitting. The fusion-fission mechanism is suggested by the model. Comparison to experimental data locates the reaction angular momentum window in the region of superdeformed nuclei.

13428 **(ITEF—32(1986)) Half-lives of neutron-rich nuclei and estimation of astrophysical r-processes duration.** Lyutostanskij, Yu.S.; Panov, I.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701367/JAW.

Microscopic model for the calculations of β-decay half-lives for neutron-rich nuclei is presented. Accuracy of the β-decay half-lives calculations is 40+50%. The dependence of r-process duration tau/sub A/ from temperature and neutron density is analysed. The minimal values of r-process duration under different conditions corresponding to the beginning of the heavy nuclei (A $\geqq$ 240) synthesis are calculated. They restrict characteristic time in the dynamical model of the stellar explosion. So the nucleosynthesis problem must be treated selfconsistently using both nuclear models and hydrodynamical stellar calculations. 29 refs.; 5 figs.

13429 **(JINR-E—4-86-760) Radiative capture of polarized muons on /sup 16/O and /sup 40/Ca.** Gmitro, M.; Kamalov, S.S.; Ovchinnikova, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701147/JAW.

Submitted to the journal Nucl. Phys. A.

The coefficient of asymmetry of photon angular distribution and circular polarization of photons for radiation capture of polarized muons by /sup 16/O ad /sup 40/Ca nuclei are calculated. The continuity equation for nuclear electromagnetic current was applied for plotting the operator of the process. Characteristics of muon radiation capture by nuclei are obtained by summing up separate partial transitions. Nuclear states are described within a microscopic shell model. High sensitivity of the coefficient of asymmetry and circular polarization to the constant of induced pseudoscalar interaction g/sub p/ and weak dependence of these characteristics on structure details of nuclear states are found. Comparison with the experiment gives the value for g/sub p/ equal to g/sub p/=11+-8. A large error in experimental measurements does not permit to make definite conclusions. 10 refs.; 1 fig.; 1 tab.

13430 **(JINR-E—4-87-35) Role of polarizability in the / sup 3/H(d,n)/sup 4/He reaction.** Belyaev, V.B.; Kuzmichev, V.E.; Peresypkin, V.V.; Zepalova, M.L. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Theoretical Physics; AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701148/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The influence is investigated of the deuteron electric dipole polarizability on the cross section, astrophysical S-factor, and the yield of helium nuclei in the /sup 3/H(d,n)/sup 4/He reaction in the region of extremely low energies. Prediction is made of the existence of narrow maximum in the cross section at energies of an incident triton lower that 10 keV produced by the action of an attractive polarization potential in the d/sup 3/H system. The growth of the cross section of d/sup 3/H reaction increases the yield of / sup 4/He nuclei at temperatures lower than keV. 13 refs.; 3 figs.; 1 tab.

13431 **(Juel-Spez—402) Electromagnetic processes in relativistic heavy ion collisions.** Bertulani, C.A. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.. Inst. fuer Kernphysik; Rio de Janeiro Univ., Brazil. Inst. de Fisica). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bonn Univ. (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Rio de Janeiro Univ. (Brazil). Inst. de Fisica). May 1987. 101p. NTIS (US Sales Only), PC A06/ MF A01. Order Number TI88751963/JAW.

A study of the processes generated by the electromagnetic interaction in relativistic nuclear, and atomic collisions is presented. Very strong electromagnetic fields for a very short time are present in distant collisions with no nuclear contact. Such fields can also lead to interesting effects, which are discussed here.

13432 **(KFTI—87-1) Polarization phenomena in the e-vector d-vector -> enp process. Neutron electric form fa>ctor and deuteron structure.** Rekalo, M.N.; Gakh, G.I.; Rekalo, A.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701192/JAW.

Polarization effects in the e/sup -/d->e/sup -/np process with longitudinally polarized electrons and vector polarized deuterons have been studied in the relativistic impulse approximation (which takes into account the t-, u-, s-channel pole and contact diagrams). The polarization observables which are most sensitive to the neutron electric form factor G/sub En/ value have been determined. When calculating both the relativistic Buck-Gross deuteron wave function (DWF) and DWF for the Paris and Reid soft-core potentials are used. In the region of the quasielastic peak (at the nucleon emission angle Θ/sub p/=0 deg or 180 deg in c.m.s. of the np-system) the investigated asymmetries are practically independent of the DWF choice. The calculation shows that the asymmetries which are caused by the deuteron spin orientation perpendicular to the momentum transfer are most suitable for the G/sub En/ determination. 18 refs.; 8 figs.

13433 **(KFTI—87-13) Calculation of helical amplitudes for the ed -> eπ/sup 0/d process.** Zayats, A.A.; Omelaenko, A.S.; Semisalov, I.L. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701193/JAW.

Helical amplitudes of ed -> eπ/sup 0/d process in the impulse approximation taking into account diagrams of π-meson rescattering are calculated. Expression under the integral sign is calculated at two effective momenta: q-vector'=q-vector (approximation 1) and q-vector'q-vector+1/2Q-vector (approximation 2). 8 refs.; 1 fig.

13434 **(KIYI—87-4) Calculation of functions of a parabolic cylinder in models of dynamic nuclear structure and nucleon-nucleus scattering.** Kashuba, I.E.; Sukhovitskij, E.Sh. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701208/JAW.

The methods of function calculations of parabolic cylinder and its proper values in a range of real values of argument are developed. A problem of integral calculation is considered, containing the function composition of parabolic cylinder occurred in a theory of nucleon scattering by nonaxial soft nuclei. 12 refs.; 2 tabs.

13435 **(LA-UR—87-3709) Monte Carlo simulation of inclusive pionic reaction around resonance and higher energy perspectives.** Oset, E.; Salcedo, L.L.; Strottman, D.; Vicente, M.J.; Garcia-Recio, C.; Hernandez, E. (Los Alamos National Lab., NM (USA); Massachusetts Inst. of Tech., Cambridge (USA). Center for Theoretical Physics; Valencia Univ. (Spain). Facultad de Fisica; Valladolid Univ. (Spain). Dept. Fisica Atomica y Nuclear; Valencia Univ. (Spain). Dept. de Fisica Teorica). 1987. Contract W-7405-ENG-36. 20p. (CONF-8708102—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003178/JAW.

From Pion nucleus physics: future directions and new facilities at LAMPF workshop; Los Alamos, NM, USA (17 Aug 1987).

We describe all the inclusive pionic reactions in a variety of nuclei around the resonance region by means of a microscopic many-body calculation that evaluates reaction probabilities, followed by a Monte Carlo simulation which follows the evolution of the pions. We also make an intrusion into the higher energy domain by paying attention to the absorption mechanisms and their repercussions in exclusive single-charge exchange reactions. 27 refs., 11 figs.

13436 **High-spin excitations in the rotating frame and sudden approximations.** Esbensen, H.; Landowne, S.; Price, C. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2359-2364(Dec 1987). Contract W-31-109-ENG-38.

The rotating frame approximation and the sudden limit are compared to exact calculations for nuclear collisions that excite high-spin states.

13437 **Deuteron properties of the coupled nucleon and isobar channels model.** Sitarski, W.P.; Blunden, P.G.; Lomon, E.L. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2479-2494(Dec 1987).

The system of NN, NΔ, ΔΔ, and NN/sup */(1440) channels, coupled by long-range meson exchange forces and a short-range boundary condition, has been successfully applied to medium energy NN scattering. The deuteron system includes the NN($^3S_1$, $^3D_1$), ΔΔ($^3S_1$, $^3D_1$, $^7D_1$), and NN*($^3S_1$) channels. The scattering data for nucleon T/sub lab/<1 GeV put strong restrictions on the short-range parameters of the model, imposing ~2% total isobar content in the deuteron, but do not determine the relative strength of coupling among the isobar channels. In contrast, the deuteron elastic magnetic form factor is sensitive to the mixture of isobars. Adding meson exchange current contributions, a good fit to these data can be achieved, including a nontrivial prediction of a minimum near q^2 = 50 fm/sup -2/, by a balance between ΔΔ($^3D_1$, $^7D_1$) components. Balancing ΔΔ($^3S_1$, $^7D_1$) with NN/sup */($^3S_1$), assuming a negative N/sup */ isoscalar magnetic moment, is only adequate for q^2<25 fm/sup -2/. The static properties of the deuteron are well fitted, and the electric and tensor polarization form factors are consistent with the data. The inclusion of the lowest six-quark state, with cloudy bag model dynamics, increases the boundary radius, requiring ~7% isobar content proportioned as above to approximately fit the data.

13438 **Systematics of light deformed nuclei in relativistic mean-field models.** Furnstahl, R.J.; Price, C.E.; Walker, G.E. (Physics Department and Nuclear Theory Center, Indiana University, Bloomington, Indiana 47405). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2590-2600(Dec 1987).

Ground-state properties of even-even nuclei in the s-d shell are calculated using relativistic mean-field models of baryon-meson dynamics that include scalar meson self couplings. Axial symmetry is assumed. The systematics of intrinsic quadrupole moments are studied for a variety of parameter sets that are fitted to the same nuclear matter saturation properties. The size of the moment is strongly correlated with the nucleon effective mass M/sup */ and the spin-orbit strength, but is only weakly affected by the compressibility or the surface energy. If parameter sets with accurate spin-orbit strengths are used, the trends for s-d nuclei reproduce experimental systematics and are quantitatively similar to those obtained in nonrelativistic Skyrme-Hartree-Fock calculations. The implications for quantum hadrodynamics in the mean-field (Hartree) and one-loop approximations are discussed.

13439 **SU(3) x SU(4) limit of an isospin invariant fermion dynamical symmetry model.** Halse, P.; Ginocchio, J.N. (Department of Physics, University of Arizona, Tucson, Arizona 85721). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2611-2617(Dec 1987).

The SU(3) x SU(4) symmetry limit appropriate for a pseudo-orbit pseudospin k = 1 i = (3/2 decomposition of the single particle angular momenta j = (1/2, (3/2, and (5/2, incorporated in the recently suggested fermion dynamical symmetry model, is discussed for the case of degenerate protons and neutrons. A comparison of the corresponding states with realistic sd shell wave functions is used to determine the validity of the symmetry for rotational even-even nuclei in this region. /sup 20/Ne is well described, with a single representation accurately reproducing both high and low spin members of the ground band, while /sup 22/Ne and /sup 24/Mg display strong symmetry breaking. It is shown that a scheme based on k-i basis intrinsic states accounts for the success in /sup 20/Ne.

13440 **Excitation of the Δ(3,3) resonance in compressed finite nuclei from a constrained mean-field method.** Hasan, M.A.; Koehler, S.; Vary, J.P. (Department of Physics, University of Arizona, Tucson, Arizona 85721). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2649-2660(Dec 1987).

In this paper we present a nonrelativistic microscopic mean-field framework for finite nuclei in which the nucleus is described as a system of A baryons where each baryon is a dynamically determined superposition of a nucleon (N) and a Δ(3,3) resonance. The N-N interaction is a Brueckner G matrix based on the Reid soft-core interaction while the N-Δ transition potentials and Δ-Δ interactions are one-boson-exchange potentials. The ground-state properties of the nuclei /sup 16/O and /sup 40/Ca are determined within the spherical Hartree-Fock approximation in a no-core basis consisting of up to six major oscillator shells. A detailed study of the zero-temperature properties of these nuclei under compression and dilation is presented in order to gain insight into the nuclear equation of state. Under certain conditions, a transition to a mixture of nucleons and deltas is found in /sup 40/Ca but not in /sup 16/O. The transition is reminiscent of a first-order phase transition.

13441 **Application of a theory of large amplitude collective motion to a generalized landscape model.** Bulgac, A.; Klein, A.; Do Dang, G. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2672-2679(Dec 1987).

The classical theory of large amplitude collective motion described in a previous paper is applied to a model with three degrees of freedom, in which the potential energy function has landscape features such as a valley which provides the easiest means, both classically and quantum mechanically, for a "particle" to escape from the center of the potential, a local minimum, to the "outside world." We analyze exhaustively the problem of decoupling two collective degrees of freedom from the original three coordinates.

We compute the two-dimensional surface to which the collective motion is (approximately) confined. This function in turn determines the collective Hamiltonian. We suggest and apply various criteria for measuring the goodness of the decoupling, and achieve a clear understanding of the domain of applicability of the analysis.

13442 **Unified description of the neutron-/sup 208/Pb mean field between -20 and +165 MeV from the dispersion relation constraint.** Johnson, C.H.; Horen, D.J.; Mahaux, C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2252-2273(Dec 1987). Contract AC05-84OR21400.

The real part of the central neutron-/sup 208/Pb mean field is the sum of a Hartree-Fock component plus a dispersive component. In keeping with theoretical expectations, the Hartree-Fock field is assumed to have a Woods-Saxon shape whose depth decreases exponentially with increasing energy and whose radius and diffuseness are independent of energy. The dispersive component is determined from the imaginary part of the optical-model potential by making use of the dispersion relation which connects these two quantities. The imaginary part is written as the sum of a volume and a surface-peaked contribution. The dispersion relation then implies that the real dispersive contribution is also the sum of volume and surface-peaked components. The parameters of the complex mean field are determined by fitting the available differential and polarization cross sections in the energy domain [4, 40 MeV] and the total cross sections in the domain [1,120 MeV]; these data are contained in previous published or unpublished reports, but new measurements of the total cross sections are presented from 1 to 25 MeV. Good fits to these cross sections, and also to unpublished total cross sections for energies up to 165 MeV, are obtained despite the fact that the number of adjusted parameters is quite small because of our use of the constraint implied by the dispersion relation.

13443 **Medium energy proton scattering from /sup 154/Gd and the interacting boson model of nuclei.** Ginocchio, J.N.; Wenes, G.; Amado, R.D.; Cook, D.C.; Hintz, N.M.; Gazzaly, M.M. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2436-2441(Dec 1987).

The interacting boson model of nuclei is used to study 650 MeV proton scattering to the J/sup π//sub i/ = $0^+_1, 2^+$/sub 1,3/ state in /sup 154/Gd. All coupled channels within the interacting boson model space are included. The hadronic boson quadrupole operator is determined. Comparison with the electromagnetic boson quadrupole operator suggests that the 2_2^+ state is not completely symmetric in the neutron and proton degrees of freedom.

13444 **Quark model of the πp pp→pn reaction.** Miller, G.A.; Gal, A. (Institute for Nuclear Theory, Department of Physics, University of Washington, Seattle, Washington 98195). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2450-2458(Dec 1987).

A model employing quark dynamics is applied to the $\pi^- + pp \rightarrow pn$ reaction. Quark effects can provide a substantial contribution to the total absorption cross section, and qualitatively reproduce the measured angular distributions.

13445 **One- and two-step contributions to the /sup 90/Zr(p,n)/sup 90/Nb cross section at 0°.** Smith, R.D.; Wambach, J. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *C: Nuclear Physics;* **36**: No. 6, 2704-2706(Dec 1987). Contract W-7405-ENG-48.

Within a multiple collision theory based on the eikonal approximation we study the /sup 90/Zr(p,n)/sup 90/Nb 0° cross section at 200 MeV incident proton energy. Both the one- and two-step contributions are calculated and compared to the experimental inclusive cross section. Good agreement between theory and experiment is found. Possible implications for the "missing Gamow-Teller strength" are discussed.

13446 **Fazely and Liu reply.** Fazely, A.; Liu, L.C. (Department of Physics, Louisiana State University, Baton Rouge, Louisiana 70803). *Physical Review Letters;* **59**: No. 20, 2384(16 Nov 1987).

The Delta-Delta process in neutrinoless double beta decay is discussed. (AIP)

13447 **Isovector monopole excitation energies.** Bowman, J.D.; Lipparini, E.; Stringary, S. (Los Alamos National Lab., NM, USA; Trento Univ., Italy. Dipartimento di Fisica; Istituto Nazionale di Fisica Nucleare, Padua, Italy). *Physics Letters* [*Section*] *B;* **197**: No. 4, 497-499(5 Nov 1987).

Using a hydrodynamical model whose parameters have been adjusted to fit the polarizability and excitation energy of the giant dipole nuclear resonance we predict excitation energies of the isovector monopole resonance. The predicted values are in good agreement with experimental data. The mass dependence of the excitation energy is strongly influenced by nuclear geometry.

13448 **Geometrical interpretation of SO(7): A critical dynamical symmetry.** Zhang, W.; Feng, D.H.; Ginocchio, J.N. (Department of Physics and Atmospheric Science, Drexel University, Philadelphia, Pennsylvania 19104). *Physical Review Letters;* **59**: No. 18, 2032-2035(2 Nov 1987).

Potential-energy surfaces are obtained for the three dynamical-symmetry chains of SO(8) within the fermion-dynamical-symmetry model. A remarkable feature is that the SO(7) dynamical symmetry is transitional and β soft. The transitional or "critical" behavior of SO(7) is vividly demonstrated.

13449 **Isospin and macroscopic models for the excitation of giant resonances and other collective states.** Satchler, G.R. (Oak Ridge National Lab., TN, USA). *Nuclear Physics* [*Section*] *A;* **472**: No. 2, 215-236(28 Sep 1987). Contract AC05-84OR21400.

Recently there has been some confusion over the excitation of 'isovector' giant resonances by isoscalar probes. We present a unified theoretical description of macroscopic models that may be used to calculate the excitation of giant resonances by inelastic scattering so as to clarify this and related questions. Particular attention is given to the relative phase of the Coulombic and hadronic contributions. After describing models for the transition densities that are based upon certain sum rules, a folding model and a deformed optical potential model for the transition potentials are discussed. Applications are made to some examples of inelastic α-particle scattering and the two models are compared. Folding yields cross sections for the breathing-mode monopole resonance that are smaller than those from the potential model by almost a factor of two, so that the measured values appear to require more than 100% depletion of the sum rule. It is suggested that this might be due to neglect of density dependence in the effective interaction.

13450 **Microscopic and conventional optical model analysis of neutron elastic scattering at 21.6 MeV over a wide mass range.** Olsson, N.; Trostell, B.; Ramstroem, E.; Holmqvist, B.; Dietrich, F.S. (Studsvik Neutron Research Lab., Nykoeping, Sweden; Lawrence Livermore National Lab., CA, USA). *Nuclear Physics* [*Section*] *A;* **472**: No. 2, 237-268(28 Sep 1987). Contract W-7405-ENG-48.

Differential fast neutron elastic scattering distributions have been measured at 21.6 MeV for the natural elements Mg, Al, Si, S, Ca, Cr, Fe, Co, Ni, Y, Ce, Pb/sub r/ (radiogenic lead) and Bi by employing pulsed beam time-of-flight techniques. The energy resolution was about 0.5 MeV (FWHM) throughout the measurements. The experimental data have been analysed in terms of a standard phenomenological spherical optical model. Potential depths and geometrical parameters were determined from individual best fits to the data. Volume integrals of the real and imaginary parts of the potential were calculated using these parameters. A similar technique was utilized to calculate root mean square radii of the real potential, from which radii of point matter distributions were obtained for comparison with α-particle scattering data at 166 MeV and with charge distribution radii from electron scattering. Microscopic folding models for the optical potential according to Jeukenne, Lejeune and Mahaux, Brieva and Rook, and Yamaguchi et

al. have been tested by calculating angular distributions, volume integrals and root mean square radii for the real and imaginary potential parts. The results of these calculations are compared with those of the phenomenological analyses. The microscopic potentials have also been intercompared by studying introduced normalizing parameters of the real and imaginary potential parts as well as isovector and isoscalar contributions to the volume integrals.

13451 **Deep inelastic scattering from the nuclear medium.** Johnson, M.B.; Speth, J. (Los Alamos National Lab., NM, USA). *Nuclear Physics [Section] A;* 470: No. 3/4, 488-508(31 Aug 1987).

We reexamine deep inelastic scattering from nuclei under assumptions commonly employed in the literature: That quarks remain confined in hadronic constituents of nuclei, that the nuclear cross section is the average of the free-space cross section of hadron i weighted by the probability of finding i in the nucleus, and that there are no final state interactions between the debris of hadron i and the rest of the nucleus. We develop a cluster expansion for the cross section of deep inelastic lepton scattering and the Drell-Yan process on nuclei. Using the 'instant' form of dynamics, we find that large contributions to these processes arise from nuclear interactions and correlations. However, our theory differs in detail from other approaches, and we find that binding alone is unlikely to explain the EMC effect. Also, in contrast to many recent papers on the subject, we conclude that the contribution of pions (and other nonnucleonic consistuents of the nucleus) is strongly suppressed.

13452 **Clustering aspects of nuclear structure and reactions.** Betts, R.R.; Rae, W.D.M. (Argonne National Lab., IL, USA; Oxford Univ., UK. Dept. of Nuclear Physics). pp 189-203 of Proceedings of the international nuclear physics conference, Harrogate, U.K., 25-30 August 1986. V.2. Invited papers. Durell, J.L.; Irvine, J.M.; Morrison, G.C. (eds.). Bristol, England; Inst. of Physics (1987). (CONF-860802—).

From International nuclear physics conference; Harrogate, UK (25 Aug 1986).

Some aspects of clustering phenomena in nuclear structure and reactions are reviewed. Particular emphasis is placed on the relationship between cluster-like states and shape-isomeric states which arise as a result of shell effects in deformed potentials. Some recent evidence in favour of this connection is presented and discussed.

13453 **The muon sticking factor in muon catalyzed fusion and the other aspect of this fusion process.** Takahashi, H. (Brookhaven National Lab., Upton, NY). pp 181-184 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—).

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

The effect of resonance nuclear fusion reaction on the initial muon sticking factor is formulated. The analysis shows that it is very sensitive to the resonance parameter, and the factor calculated, using the molecular wave function obtained by the Diffusion Monte Carlo method, is 0.1+-0.01 for the presently evaluated resonance parameter. The analysis of the multistep excitation effect on the reactivation factor shows that the effect is not so large, and the analysis of muonic x-ray spectra of /sub μ//sup 3/He from P/sub μ/d and d/sub μ/d fusions is in good agreement with the values measured by others. The use of coherent x-ray for stripping muons sticking to the α particle in d/sub μ/t fusion is discussed. The ionization cross section by coherent x-ray, whose energy is less than the ionization energy, is appreciable in the case when the vector potential produced by coherent x-ray becomes more than 10/sup 7/ volt. The trajectories of π/sup -/ meson, which is produced by hadron collision with - low A target, under the B/sub θ/ and B/sub z/ magnetic fields are studied, together with the use of single crystal beam window for muon catalyzed fusion reactor.

13454 **Uncertainty propagation from raw data to final results.** Larson, N.M. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 96: No. 1-4, 251-254(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Reduction of data from raw numbers (counts per channel) to physically meaningful quantities (such as cross sections) is in itself a complicated procedure. Propagation of experimental uncertainties through that reduction process has sometimes been perceived as even more difficult, if not impossible. At the Oak Ridge Electron Linear Accelerator, a computer code ALEX has been developed to assist in the propagation process. The purpose of ALEX is to carefully and correctly propagate all experimental uncertainties through the entire reduction procedure, yielding the complete covariance matrix for the reduced data, while requiring little additional input from the experimentalist beyond that which is needed for the data reduction itself. The theoretical method used in ALEX is described, with emphasis on transmission measurements. Application to the natural iron and natural nickel measurements of D.C. Larson is shown.

13455 **Prompt neutron multiplicities for the transplutonium nuclides.** Holden, N.E.; Zucker, M.S. (Brookhaven National Lab., Upton, NY, USA). *Radiation Effects;* 96: No. 1-4, 289-292(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

In reponse to a need of the safeguards community, we have begun an evaluation effort to upgrade the values of the prompt neutron emission multiplicity distribution from fission, Psub(upsilon), and its average value <upsilon>. The reported Psub(upsilon) for various transplutonium nuclides have been renormalized via an independent evaluation of <upsilon>. Recommended values and uncertainties are given for the newly evaluated <upsilon> and Psub(upsilon).

13456 **Effect of fission dynamics on the spectra and multiplicities of prompt fission neutrons.** Nix, J.R.; Madland, D.G.; Sierk, A.J. (Los Alamos National Lab., NM, USA). *Radiation Effects;* 92: No. 1-4, 263-276(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Recent advances in a unified macroscopic-microscopic description of large-amplitude collective nuclear dynamics are examined. The macroscopic-microscopic method is described with respect to potential energy, kinetic energy, dissipation mechanism and equations of motion. Dynamical fission calculations, prompt fission neutron spectrum, average prompt neutron multiplicity, and scission neutrons, are also discussed. (U.K.).

13457 **R-matrix analysis of the ^{7}Li system with peripheral channel overlap exchange effects.** Hale, G.M. (Los Alamos National Lab., NM, USA). *Radiation Effects;* 95: No. 1-4, 97-101(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The parameters of the R-matrix analysis that includes data for all reactions open in the ^{7}Li system at Esub(x) <= 10 MeV suggest that deuteron exchange contributes to the low-energy ^{6}Li(n,t) reaction. A method for including this mechanism directly in the theory is discussed and preliminary results are given.

13458 **Pairing correction of particle-hole state densities for two kinds of Fermions.** Fu, C.Y. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* 95: No. 1-4, 109-113(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Pairing corrections in particle-hole (exciton) state-density formulas used in precompound nuclear reaction theories are, strictly speaking, dependent on the nuclear excitation energy U and the exciton number n. A general formula for (U,n)-dependent pairing corrections has been derived in an earlier paper for exciton state-density formulas for one kind of Fermion. In the present paper, a similar derivation is made for two kinds of Fermions. It is shown that the constant-pairing-energy correction used in standard level-density formulas is a limiting case of the present general (U,n)-dependent results.

13459 **Los Alamos National Laboratory neutron-neutron scattering program.** Glasgow, D.W.; Moore, M.S.; Morgan, G.L. and others. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **94**: No. 1-4, 239-244(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A theoretical and experimental program is underway to determine the feasibility of a measurement of the neutron-neutron scattering cross section of 10-12% uncertainty using small-angle, low center-of-mass energy, colliding neutron beams derived from a fusion-fission nuclear source. The neutron-neutron scattering length would be inferred from the measured cross sections. The general concept of the experiments and progress are discussed.

13460 **Relativistic photon-Maxwellian electron cross sections.** Wienke, B.R.; Lathrop, B.L.; Devaney, J.J. (Los Alamos National Lab., NM, USA). *Radiation Effects;* **94**: No. 1-4, 303-306(1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Temperature corrected cross sections, complementing the Klein-Nishina set, are developed for astrophysical, plasma, and transport applications. The set is obtained from a nonlinear least squares fit to the exact photon-Maxwellian electron cross sections, using the static formula as the asymptotic basis. Two parameters are sufficient (two decimal places) to fit the exact cross sections over a range of 0-100 keV in electron temperature, and 0-1 MeV in incident photon energy. The fit is made to the total cross sections, yet the parameters predict both total and differential scattering cross sections well. Corresponding differential energy cross sections are less accurate. An extended fit to (just) the total cross sections, over the temperature and energy range 0-5 MeV, is also described.

13461 **Double beta decay: Theory.** Haxton, W.C. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 980-991(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A summary is given of interesting particle physics and nuclear physics issues in the theory of double beta decay.

13462 **Quark tunneling in hypernuclei.** Goldman, T. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 799-805(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A new model of nuclei is described. Its qualitative successes are discussed. Its implications for and new tests in hypernuclei are introduced.

13463 **Hadron physics.** Bunce, G. (Accelerator Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 31-47(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Is all hadronic physics ultimately describable by QCD? Certainly, many disparate phenomena can be understood within the QCD fremework. Also certainly, there are important questions which are open, both theoretically (little guidance, as yet) and experimentally, regarding confinement. Are there dibaryons, baryonium, glueballs? In addition, there are experimental results which at present do not have an explanation. This talk, after a short section on QCD successes and difficulties, will emphasize two experimental topics which have recent results: glueball spectroscopy and exclusive reactions at large momentum transfer. Both are experimentally accessible in the AGS/LAMPF II/AGS II/TRIUMF II/SIN II energy domain.

13464 **Nuclear hadrodynamics.** Geesaman, D.F. (Argonne National Laboratory, Argonne, IL 60439). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 150-168(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The role of hadron dynamics in the nucleus is illustrated to show the importance of nuclear medium effects in hadron interactions. The low lying hadron spectrum is considered to provide the natural collective variable for nuclear systems. Recent studies of nucleon-nucleon and delta-nucleon interactions are reviewed, with emphasis on the type of experimental phenomena which signal the importance of the many-body dynamics.

13465 **EMC effect: Asymptotic freedom with nuclear targets.** West, G.B. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 360-380(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

General features of the EMC effect are discussed with the framework of quantum chromodynamics as expressed via the operator product expansion and asymptotic freedom. These techniques are reviewed with emphasis on the target dependence.

13466 **Binding energies of hypernuclei and Λ-nuclear interactions.** Bodmer, A.R.; Usmani, Q.N. (Argonne National Laboratory, Argonne, IL 60439 and University of Illinois at Chicago, Chicago, IL 60680). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 806-812(15 Nov 1984). (CONF-8405193—). Contract W-31-109-ENG-38.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Variational calculations indicate that a reasonable description of Λp scattering and of Λ separation energies can be obtained in terms of ΛN plus dispersive and TPE ΛNN forces. Results for the ΛΛ interaction and for /sub Λ//sub Λ/^{6}He obtained from an analysis of ^{10}/sub Λ//sub Λ/Be are discussed. Coulomb and ΛN charge symmetry breaking effects in the A = 4 hypernuclei are discussed.

13467 **Properties and phases of nuclear matter.** Negele, J.W. (Center for Theoretical Physics, Laboratory for Nuclear Science, and Department of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 280-299(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The present experimental and theoretical understanding of the properties of nuclear matter is surveyed. Nuclear structure provides the most quantitative information at present, and prospects for complementary constraints from neutron stars and heavy ion collisions are discussed. The theory of the normal, superfluid, and pion-condensed states of nuclear matter is reviewed and recent results concerning quark matter and lattice gauge calculations are presented.

13468 **Quantum hadrodynamic and nuclear matter.** Serot, B.D. (Physics Department of Nuclear Theory Center, Indiana University, Bloomington, IN 47405). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 615-627(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The properties of infinite nuclear matter are studied in the model relativistic quantum field theory of Walecka. Neutral scalar and vector meson exchange reproduces the basic Lorentz structure of the observed nucleon-nucleon interaction, and the consequences of this structure are studied in detail. In the mean-field approximation, nuclear saturation involves a cancellation between large attractive and repulsive components in the average potential energy. The attractive scalar field decreases the nucleon mass significantly, and the strong vector repulsion implies a stiff high-density equation of state. Corrections to the mean-field approach arising from vacuum fluctuations, self-consistent nucleon exchange, and two-nu-

cleon correlations are examined. These have a small effect on the condensed meson fields but may produce significant changes in the binding energy. Corrections to the mean-field equation of state are small at high density.

13469 **Classical behavior in high temperature chromodynamics.** Sivers, D. (High Energy Physics Division, Argonne National Laboratory, Argonne, IL 60439). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 770-773(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A classical chromodynamic approach to the description of high temperature hadronic matter is discussed. (AIP)

13470 **Relativistic theory of electron-nucleus scattering.** Serot, B.D. (Physics Department and Nuclear Theory Center, Indiana University, Bloomington, IN 47405). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 510-520(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A consistent relativistic formalism is developed for electron-nucleus scattering. It is based on renormalizable relativistic quantum field theories of mesons and baryons (quantum hadrodynamics). The relativistic Hartree approximation describes the target using four-component Dirac wave functions. An effective, local electromagnetic current operator is constructed that reproduces electron scattering from a single nucleon. This operator is explicitly conserved in the relativistic Hartree approximation and, together with the Hatree wave functions, provides a consistent covariant formalism for electron-nucleus scattering. Applications of the formalism to elastic charge and magnetic scattering are discussed.

13471 **Kaon electromagnetic production and hypernuclear excitation.** Contanch, S.R.; Hsiao, S.S. (North Carolina State University, Raleigh, NC 27695-8202). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 778-782(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Kaon (K^+ meson) photo and electroproduction of Λ hypernuclei is theoretically investigated. Impulse approximation calculations using elementary amplitudes describing the $\gamma+p\rightarrow K^++\Lambda$ process are performed for d, ^{4}He, ^{12}C, and /sup 208/Pb targets at lab energies between threshold and several GeV. Predicted cross sections yield reasonable count rates for meaningful measurements using continuous, intense electron beams. First generation experiments should provide new and improved information concerning: 1) the Λ nucleon and nucleus interaction; 2) the longitudinal hypernuclear form factor; 3) unnatural parity high spin states. Calculations are also reported for the deuteron electrodisintegration process d(e,e'K$^+$)Λn. Study of this reaction will permit an accurate extraction of the inospin zero KN scattering amplitude and needed information about the kaon form factor.

13472 **ΛN effective interaction.** Millener, D.J. (Brookhaven National Laboratory, Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 850-855(15 Nov 1984). (CONF-8405193—). Contract AC02-76CH00016.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

A combination of theoretical estimates, based on a ΛN potential model, and phenomenological analysis of hypernuclear data is used to determine a set of four p/sub N/S/sub Λ/ two-body matrix elements which characterize the spin dependence of the ΛN interaction in the p shell. The central spin-spin and the Λ spin-orbit matrix elements are most strongly constrained by existing data. The spin dependence is weak in the sense that s/sub Λ/ doublet splittings are predicted to be of order 100 keV except for the special case of ^{7}/sub Λ/Li where the central spin-spin interaction dominates and the ground-state doublet separation is likely to be about 600 keV. The results of recent (K^-, $\pi^-\gamma$) experiments at the Brookhaven AGS are interpreted in terms of the ΛN effective interaction.

13473 **K$^+$-nucleus interaction.** Gibbs, W.R. (Los Alamos National Laboratory, Los Alamos, NM 87545). *AIP (American Institute of Physics) Conference Proceedings;* **123**: No. 1, 859-866(15 Nov 1984). (CONF-8405193—).

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The K$^+$-nucleus system is reviewed and comparison with data is made. The principal conclusions are that the theoretical uncertainties in relating the K$^+$-nucleus interaction to the K$^+$-nucleon interaction are very small and hence the positive kaon makes an excellent probe of the nucleus. It is suggested that this particle may be more sensitive to the non-nucleonic degrees of freedom (especially quarks) than classical probes.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 11628, 12034, 12363, 12373, 13499, 13517

13474 **(FEI—1794) Construction of some effective modifications of the Monte Carlo method for solution of the problems of radiation transport.** Androsenko, A.A.; Androsenko, P.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701013/JAW.

Construction of some nonanalogous modifications of the Monte Carlo method permitting to solve efficiently definite classes of the problems of radiation transport is considered. All modifications are based on the assumption that there is no prior information on the problem solution. 5 refs.

13475 **(FEI—1806) Contribution field and its application in shielding problems. Properties and forms of contribution field representation.** Khokhlov, G.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701016/JAW.

Properties of a contribution field from the point of view of the field theory and mechanics of the continuum are considered. Fundamental field equations are derived in the kinetic and diffusion approximations of transport theory. The vortex character of the contribution field is established. The tensor form of the field representation is used to study the character of contribution motion in space. Expressions for a pseudopotential and scalar and vector potentials of the field in the diffusion approximation are obtained. 11 refs.; 2 figs.

13476 **(FEI—1843) Geometrical module for calculation of systems with zone broken line boundaries using Monte Carlo method.** Leont'ev, V.V.; Polevoj, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701018/JAW.

A module permitting to calculate systems with broken line boundaries of radial zones and to simulate radiation transport in real systems is developed on the basis of PRS geometric module. The module is aimed at working with complex of MMKFK programs. The main principles of particle trajectory plotting are described. The structure of input and output data of the main subprograms of the module is given. Stages of testing are described. Example of calculation of critical assembly of complex geometry is provided. 5 refs.; 3 figs.

13477 (INIS-SU—431, pp 430) **On possible parity nonconservation in ultracold neutron interaction with matter.** Barabanov, A.L. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13478 (INIS-SU—431, pp 438) **On value of T-nonvariant P-even effect in neutron optics.** Bunakov, V.E.; Gudkov, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13479 (PB—88-129325/XAB) **Technical activities 1987, Center for Radiation Research.** Kuyatt, C.E. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Oct 1987. 267p. (NBSIR—87/3571). NTIS, PC A12/MF A01.

See also PB—87-140232.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1987 in the NBS Center for Radiation Research. These activities fall in the area of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

13480 **Calculation of neutron cross sections and thermalization parameters for molecular gases using a synthetic scattering function. II. Applications to H_2O, D_2O, and C_6H_6.** Granada, J.R.; Gillette, V.H.; Mayer, R.E. (Centro Atomico Bariloche and Instituto Balseiro, Comision Nacional de Energia Atomica, 8400 San Carlos de Bariloche, Argentina). *Physical Review [Section] A: General Physics;* **36**: No. 12, 5594-5605(15 Dec 1987).

The formulas derived from the synthetic model which were presented in the preceding paper are here applied to the evaluation of partial and total cross sections at thermal neutron energies for the commonly used moderators H_2O, D_2O, and C_6H_6. The results of our analytical expressions for the scattering kernels $\sigma_0(E_0,E)$ and $\sigma_1(E_0,E)$ are compared with standard code calculations for well-separated incident neutron energies E_0. The related integral quantities, total cross section $\sigma(E_0)$, and average cosine of the scattering angle $\langle\cos\theta(E_0)\rangle$, respectively, are also compared with experimental data and results from other theories. Within the framework of neutron diffusion theory, transport coefficients are readily evaluated using the model expressions and they are compared with available information over a wide range of temperatures.

13481 **Density dependence of the stopping mean excitation energy.** Peek, J.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **36**: No. 11, 5429-5431(1 Dec 1987).

The local-plasma model for the stopping mean excitation energy I(0) of Lindhard and Scharff is used to investigate the effects of target density. The use of the Thomas-Fermi electron density produces a universal curve for I(0)/Z, where Z is the nuclear charge number, as a function of the target density. Experimental data for I(0) are shown to be in good agreement with this predicted curve. A simple formula is derived for I(0) in the limit of high target density. This approach is known to predict a similar curve for the charge dependence of I(0)/Z for atomic ion targets. Numerical comparisons and an asymptotic formula for the large-charge limit are presented for this case.

13482 **Trapping of nonthermal positrons in metals.** Lynn, K.G.; McKay, T.; Nielsen, B. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **36**: No. 13, 7107-7110(1 Nov 1987).

A study aimed at calculating the probability of a nonthermalized positron being localized at a thermally generated defect is examined. We find that by utilizing the theoretical works of Perkins and Carbotte and McMullen and Stott a significant fraction of positrons are localized before reaching equilibrium with the lattice. These results are compared with both bulk positron lifetime and variable-energy positron data. Implication of these results are discussed.

13483 **Study of phonon dispersion relations in forsterite, Mg/sub 2/SiO/sub 4/ by inelastic neutron scattering.** Ghose, S.; Hastings, J.M.; Corliss, L.M.; Rao, K.R.; Chaplot, S.L.; Choudhury, N. (Washington Univ., Seattle, USA. Dept. of Geology; Brookhaven National Lab., Upton, NY, USA; Bhabha Atomic Research Centre, Bombay, India. Nuclear Physics Div.). *Solid State Communications;* **63**: No. 11, 1045-1050(Sep 1987).

Phonon dispersion relations in forsterite, Mg/sub 2/SiO/sub 4/ have been determined under ambient conditions using inelastic neutron scattering (INS). Nine acoustic and seventeen optic branches have been measured along the three principle symmetry directions in the Brillouin zone. Seven zone center phonons have been observed with frequencies, which are in good agreement with Raman and infra red measurements, except the lowest frequency phonon at 104cm/sup -1/, which is Raman and IR inactive and has been observed for the first time in INS. In order to select suitable wave vector transfers for phonon measurements, the one-phonon neutron structure factors predicted from a lattice-dynamical rigid ion molecular model were used as guides for the INS experiment. The measured dispersion relations agree very well with those predicted from a rigid 'molecular' ion model, where the tetrahedral [SiO/sub 4/] unit is assumed to be a rigid group. The elastic constants determined from the slopes of the acoustic branches show good agreement with those measured by ultrasonic techniques.

13484 **Parameters of the 1.056-eV resonance in /sup 240/Pu and the 2200 m/s neutron total cross sections of /sup 235/U, /sup 239/Pu, and /sup 240/Pu.** Spencer, R.R.; Harvey, J.A.; Hill, N.W.; Weston, L. (Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN 37831-6354). *Nuclear Science and Engineering;* **96**: No. 4, 318-329(Aug 1987). Contract AC05-84OR21400.

The Bayesian method was applied to the simultaneous fitting of neutron transmission measurements on five thin and two thick samples of /sup 240/Pu to obtain the parameters of the very large resonance near 1 eV. The results of the analysis are E/sub 0/ = 1.0564 +- 0.0006 eV, Γ/sub γ/ = 30.3 +- 0.3 meV, and Γ/sub n/ = 2.45 +- 0.02 meV. Some evidence in the data of a small deviation from the usual "weak binding" model for Doppler broadening of the theoretical resonance shape is presented. Transmission measurements on samples of /sup 235/U, /sup 239/Pu, and /sup 240/Pu also were made over the thermal energy region and their neutron total cross sections were derived. Fits of the form $A\sqrt{E} + B$ to the cross-section data in the interval from 0.02 to 0.03 eV resulted in the values 690 +- 5, 1025 +- 6, and 284 +- 2 b for the 2200 m/s total cross sections of /sup 235/U, /sup 239/Pu, and /sup 240/Pu, respectively.

13485 **Microscopic dosimetry of ions in nanometer sites: Touchers.** Wilson, W.E.; Paretzke, H.G. (Pacific Northwest Lab., Richland, WA). pp 119 of Thirty-fifth annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1987). (CONF-870221—). Contract AC06-76RL01830.

From 35. annual meeting of the Radiation Research Society; Atlanta, GA, USA (22 Feb 1987).

Extensive Monte Carlo calculations of ionization and energy deposition produced when MeV protons pass near, but outside micron absorber sites have been performed. Energy and ionization deposition within the sites is produced bu secondary electrons (delta-rays) ejected by the proton along its path. The computations indicate that the probability for a nanometer site experiencing any ionization deposition decreases very rapidly with radial distance from the path of the ion (eccentricity) and the functional dependence on eccentricity appears to approach 1/r**2 asymptotically for high velocity ion. This study details the systematic dependence of the deposited energy and ionization on site size, ion energy and eccentricity.

13486 **A device for microdosimetry in the nanometer region.** Goldhagen, P.E.; Randers-Pehrson, G. (Radiological Research Lab., College of Physicians and Surgeons of Columbia Univ., New York, NY 10032). pp 120 of Thirty-fifth annual meeting of the Radiation Research Society (Abstracts). Philadelphia, PA; Radiation Research Society (1987). (CONF-870221—).

From 35. annual meeting of the Radiation Research Society; Atlanta, GA, USA (22 Feb 1987).

The biological effects of ionizing radiation depend in part on the spatial distribution of energy deposition in volumes of biological material ranging in size from microns down to nanometers. The authors are developing a device to count ionizations from particle tracks in gas volumes simulating sites with diameters of the order of 1 to 10 nanometers. Results obtained with this device, the secondary emission scintillation counter, could be used to determine the fine structure of proximity functions for particle tracks. The device and its operating principles are described, parameters affecting its performance discussed, and preliminary results presented.

13487 **Direct mass measurements in the light neutron-rich region using a combined energy and time-of-flight technique.** Pillai, C.; Swenson, L.W.; Vieira, D.J.; Butler, G.W.; Wouters, J.M.; Rokni, S.H.; Vaziri, K.; Remsberg, L.P. (Oregon State Univ., Corvallis, USA. Dept. of Physics; Los Alamos National Lab., NM, USA; Utah State Univ., Logan, USA. Dept. of Physics; Brookhaven National Lab., Upton, NY, USA). *Radiation Effects;* **96**: No. 1-4, 41-46(Mar 1986). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

It is demonstrated that direct mass measurements can be performed using a combined energy and time-of-flight technique. This has the advantage that many particle-bound nuclei, produced in fragmentation reactions can be measured simultaneously, independent of their N or Z. The disadvantage is that both energy and time-of-flight must be measured precisely on an absolute scale. Two new masses were determined for the nuclei ^{30}N and ^{34}F. (U.K.).

6550 Medical Physics

REFER ALSO TO CITATION(S) 11056, 11056, 11151, 11507, 11628, 11630, 12497, 12678, 12689, 12698

13488 **(AERE-M—3611) Rapid method for the autoradiography of alpha active air sample filters.** Parker, R.C.; Stevens, D.C.; Pollock, J.S. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Jul 1987. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751460/JAW.

The report describes an improved version of a technique using a phosphor screen and an optical photographic emulsion to detect alpha-active particles. The sensitivity of the technique when using 'instant' high speed polaroid film is reported. The equipment has been designed to produce rapid results and does not need 'darkroom' conditions.

13489 **(CIEMAT—605) New ICRU quantities for the environmeatal and individual monitoring. Standardization of individual dosemeters by using external beams of photon radiation.** Granados, C.E.; Brosed, A.; Delgado, A. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 88p. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701260/JAW.

The quantities introduced by ICRU for the radiological monitoring are commented, specially those implied in individual protection against external photons. A procedure is proposed in order to standardize the individual dosemeters by using the kerma in air references of CIEMAT-JEN. The reference radiation beams are described in connection with ISO standards. Provisional values are selected for the appropriate conversion and correction factors. (author). 14 figs., 23 refs.

13490 **(CIEMAT—612) Measurements of very low alpha activity in water.** Acena, M.L.; Crespo, M.T. (Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas, Madrid (Spain)). 1987. 23p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701261/JAW.

Measurement of very low levels of alpha-emitting nuclides in water needs substantial improvements. A system based on the adsorbing properties of manganese dioxide eliminates the need for transporting very large volumes of water and increases the sensitivity of the measurement. (author). 7 figs., 21 refs.

13491 **(ENEA-RT-PAS—85-35) Physical quantities so far used or proposed, in radioprotetion dosimetry.** Laitano, R.F. (ENEA, Casaccia, Italy. Centro Ricerche Energia). (ENEA, Casaccia (Italy). Centro Ricerche Energia). 1985. 57p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number TI88700992/JAW.

The physical quantities so far used in radioprotection dosimetry are mainly exposure, absorbed dose, particle fluence etc. All these quantities should allow a determination of the effective dose equivalent, Hsub(E). Such determination however is not always easy and sometimes can be characterized by ambiguity. For this reason there has been during these last years a wide interest in reexamining all the matter of the operational quantities with the aim of defining a possible unique measurable quantity to be related to the effective dose equivalent for all types of radiations. What is important, however, is that any given operational quantity which allows a determination of Hsub(E) is defined in the frame of a metrological system. The various possible solutions and proposals to date available are here examined and discussed. The recent ICRU Report 39 on this argument is likely to represent a widely acceptable proposal both for specialists on radiation quantities and for others who have to put in practice requirements and recommendations in the field of radioprotection. 23 refs.

13492 **(GSF—22/87) Sixth symposium on neutron dosimetry. Scientific programme and book of abstracts.** (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). 1987. 172p. (CONF-871020—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88751274/JAW.

From 6. symposium on neutron dosimetry; Neuherberg, F.R. Germany (12 Oct 1987).

This booklet contains all abstracts of papers presented in 13 sessions. Main topics: Cross sections and Kerma factors; analytical radiobiology; detectors for personnel monitoring; secondary charged particles and microdosimetric basis of q-value for neutrons; personnel dosimetry; concepts for radiation protection; ambient monitoring; TEPC and ion chambers in radiation protection; beam dosimetry; track detectors (CR-39); dosimetry at biomedical irradiation facilities; health physics at therapy facilities; calibration for radiation protection; devices for beam dosimetry (TLD and miscellaneous); therapy and biomedical irradiation facilities; treatment planning.

13493 (INIS-mf—11081, pp 13-52) **Radiation hygiene surveillance at workplaces handling ionizing radiation sources.** 1986. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700823/JAW.

In Development of radiation hygiene in Western Slovakia in the years 1958-1984.

The history is described of the radiation hygiene division of the Regional Hygiene Station in Bratislava (CS) since 1958. The organizational structure is described and the institutions are listed where radiation surveillance was carried out. Discussed are shortcomings found during surveillance and their correction, radiation monitoring, dosimetry, monitoring of the radiation burden of personnel handling radiation sources. The action of hygiene surveillance are enumerated and some examples are shown of the interventions of the division, such as the search of a lost radiation source in the municipal sewage, the investigation of the mishandling of a source, and the decontamination of a workplace handling radioactive dyes. (M.D.).

13494 (INIS-mf—11081, pp 53-72) **Radiation hygiene surveillance in nuclear facilities.** 1986. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700823/JAW.

In Development of radiation hygiene in Western Slovakia in the years 1958-1984.

The establishment is described of hygiene surveillance for nuclear facilities in conection with the construction of the first Czechoslovak nuclear power plant. The body gained first experiences from the construction and operation of the A-1 nuclear power plant. A brief list is presented of selected preventive actions of the hygiene surveillance in the years 1960-1984 in nuclear p;ower plants A-1, V-1 and V-2 at Jaslovske Bohunice and in the Mochovce nuclear power plant. The activities are also described of the body in the years 1973-1984 during normal operation of nuclear power plants A-1, V-1 V-2. (E.S.).

13495 (INIS-mf—11081, pp 72-81) **Radiation burden in planned use of ionizing radiation sources.** 1986. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88700823/JAW.

In Development of radiation hygiene in Western Slovakia in the years 1958-1984.

From 1960, personnel exposure at X-ray departments was measured using ionization chambers. Since 1963 when film dosimetry was introduced, the number of monitored personnel handling ionizing radiation has been growing. The introduction is described of personnel dosimetry in radiotherapy, radiodiagnosis and crack detection departments and in the nuclear power plants at Jaslovske Bohunice. The dose equivalents measured for personnel of these departments in the years 1970-1984 are tabulated. In cases of overexposure or single nonuniform exposure, physical measurements were completed with an examination of the chromosome count of peripheral lymphocytes. (E.S.).

13496 (INIS-mf—11084) **South African Association of Physicists in Medicine and Biology: 26. annual congress.** (South African Association of Physicists in Medicine and Biology, Pretoria). 1986. 48p. (In Afrikaans and English). (CONF-8603229—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW.

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

The twenty-sixth annual congress of the South African Association of Physicists in Medicine and Biology was held from 18-21 March 1986 in Pretoria. Papers delivered on the conference covered subjects like medical physics, radiotherapy, radiation protection, calibration of radiation monitors, radiation detectors, radiation doses and dosimetry.

13497 (INIS-mf—11084, pp 36) **Radiation protection service's new automatic personal dosimetry system.** Baker, P.W.; De Oude, A.; Lange, E.J.; Rapley, L.F. (South African Bureau of Standards, Pretoria). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

13498 (INIS-mf—11084, pp 37) **Evaluation of radiation exposure in a thorium mine.** Bain, C.A.R.; Van As, D. (Atomic Energy Corp. of South Africa, Pty Ltd., Pretoria). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

13499 (INIS-mf—11084, pp 38) **Determination of the exposure rate and tissue attenuation of /sup 192/Ir gamma rays in brachytherapy.** Groenewald, W.A.; Pistorius, S. (Tygerberg Hospital, Bellville, South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

13500 (INIS-mf—11084, pp 39) **Elimination of errors in I-131 thyroid uptake measurements caused by prior Tc-99m scintigraphy.** Wasserman, H.J.; Mueller, C.; Klopper, J.F. (Tygerberg Hospital, Bellville, South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

13501 (INIS-mf—11084, pp 43) **Prospective estimation of intra-uterine foetal kidney dose from computed axial tomography.** Moore, R.; Guidozzi, F.; Anderson, J. (University of the Witwatersrand, Johannesburg, South Africa). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

13502 (INIS-mf—11084, pp 45) **Radon emanation and bricks.** Leuschner, A.H.; Strydom, R.; Steyn, A. (Atomic Energy Corp. of South Africa, Pty Ltd., Pretoria). 1986. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700824/JAW. (CONF-8603229—).

From 26. annual congress of the South African Association of Physicists in Medicine and Biology; Pretoria, South Africa (18 Mar 1986).

13503 (INP—1246/D) **Assessment of the rate of ionizing radiation in the protection zone of the Lenin Steelworks and the Nowa Huta Cement Factory, and consequences with respect to soils, water and agriculture.** Niewiadomski, T.; Godek, J.; Jasinska, M.; Wasiolek, P. (Institute of Nuclear Physics, Krakow (Poland)). 1983. 89p. (In Polish). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701347/JAW.

Published in 1984.

The level of radioactivity of the natural environment and its changes due to the industrial activity of the Lenin Steelworks were assessed by analysing the radioactivity of wastes from the steelworks (ashes, fly-ashes, slags and waste waters) and by studying the increase in the radioactivity of soil and plant samples taken in the region of the steelworks' protective zone. Samples of ashes, fly-ashes and soils were investigated using gamma-spectroscopy and the concentrations of /sup 226/Ra, /sup 232/Th and /sup 40/K were established. Total beta activity was measured for water and plant samples. The radioactivity of air above ground and the radioactive fallout at ground level around the steelworks was calculated. The highest inhalation and digestion doses as well as doses due to gamma irradiation from the ground at the position of highest immission were calculated in the form of effective dose equivalent committment (EDEC). We state that as a result of fly-ash inhalation the population inhabiting the critical region receives a yearly EDEC of 2 μSv, as a result of consumption of fallout contaminated food - 65 μSv, and that the yearly EDEC from external gamma radiation due to fallout radionuclides deposited on the ground is 30 μSv. The total EDEC at the place of maximum immission following from the 30-year industrial activity of the Lenin Steelworks is estimated at 100 μSv per year which constitutes c. 6% of the yearly dose committment of an inhabitant of Poland, from all natural sources. We have also found that stacked deposits of ashes and slags do not influence strongly the level of environmental radioactivity outside their area.

13504 (PB—88-108535/XAB) **NBS (National Bureau of Standards) measurement services: calibration of beta-particle-emitting ophthalmic applicators. Final report.** Pruitt, J.S. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Jul 1987. 38p. (NBS/SP—250/9). NTIS, PC A03/MF A01.

Also available from Supt. of Docs. as SN003-003-02817-7; Library of Congress catalog card no. 87-619844.

The service provides calibrations for (90)Sr + (90)Y beta-particle ophthalmic applicators. The calibration determines the average surface absorbed-dose rate to water over the active area of the applicator. The technique used is to measure current per unit mass of air at the active surface with an extrapolation ionization chamber, and to convert this into absorbed-dose rate with Bragg-Gray cavity ionization theory. The extrapolation chamber measurements are made in three parts. Data-book measurements and a calibration report are given for one particular applicator.

13505 **Angular dependence of shallow dose from energetic electrons.** Alvarez, J.L. (EG&G Idaho, Inc., Idaho Falls). *Health Physics;* 53: No. 4, 397-403(Oct 1987).

A definite angular dependence of shallow dose from energetic electrons was observed when measuring the angular response of several detectors. This angular dependence of dose appeared to be fundamental, not a detector artifact. The theoretical response of a detector is discussed and compared to measurements of shallow dose with tissue and phantom response detectors. The energy-dependent angular response of the dose observed could not be explained by simple trigonometric arguments. The response, which is backscatter-dependent, must be considered in detector design and dose measurements. It is not possible for standard detectors to follow this response.

13506 **On the dose rate indoors from building materials.** Quindos, L.S.; Newton, G.J.; Wilkening, M.H. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM, USA. Inhalation Toxicology Research Inst.; New Mexico Inst. of Mining and Technology, Socorro, USA. Dept. of Physics; New Mexico Inst. of Mining and Technology, Socorro, US. Geophysical Research Center). *Radiation Protection Dosimetry;* 19: No. 2, 125-128(1987).

Naturally occurring radioactivity in building materials constitutes a portion of the background radiation that people receive. The total dose rate from building materials to people is the result of both an external exposure from gamma emitting radionuclides in the building materials and an internal exposure from inhalation of decay products of /sup 222/Rn (radon) and /sup 220/Rn (thoron). Using methods suggested by UNSCEAR and published values of many measurements from various parts of the world, the dose from /sup 222/Rn progeny derived from building materials was calculated to be about 10% of the total exposure from radon progeny. When both radon and thoron progeny were considered, about 50% of the total dose from /sup 220/Rn progeny was radon and thoron derived from building materials. The remaining dose from radon progeny is attributed to radon in the soil gas. This has been accepted for radon but generally ignored for thoron.

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REFER ALSO TO CITATION(S) 11961, 11984, 12939, 13386, 13753

13507 **(AERE-R—12556) Facilities for and applications of the RBS channelling technique on the Harwell 5 MV Van de Graaff accelerator.** Sugden, S.; Parker, D.J.; Sofield, C.J.; Harper, R.E. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.; UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jul 1987. 33p. H.M. Stationery Office, London, price Pound 5.00.

RBS channelling is a powerful technique for the study of the crystallographic properties of near surfaces. The technique and its applications to materials analysis problems are briefly described, and the facilities or RBS channelling on the Nuclear Physics Division 5 MV Van de Graaff accelerator are then outlined. The use of the technique is demonstrated in several applications of interest to semiconductor technology.

13508 **(CONF-870701—11) Time dependent degradation of energetic electrons in gaseous and condensed media.** Dillon, M.; Kimura, M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002912/JAW.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

A transport equation formulated by Spencer and Fano has been used to calculate initial yields of products formed by electron interactions under conditions of steady state irradiation. Since experimental observation of initial yields may now be possible it is desirable to generalize the treatment of Spencer and Fano to include transient effects explicitly. 6 refs., 2 figs.

13509 **(CONF-870793—2) Free energy calculation via MD [molecular dynamics]: Methodology and application to bicrystals.** Lutsko, J.F.; Wolf, D.; Yip, S. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002902/JAW.

From Conference on interface science and engineering; Lake Placid, NY, USA (12 Jul 1987).

Three independent methods for the calculation of free energies via molecular dynamics are used to determine the free energies of crystalline solids. The relative accuracy and computational efficiency of the methods is compared and discussed. The free energies of two Cu bicrystals are then computed and compared over a wide range of temperatures and their relative stabilities are discussed. 4 refs., 4 figs.

13510 **(CONF-870793—4) Molecular dynamics study of high-temperature grain-boundary stability in a (100) $\Sigma = 29$ bicrystal model.** Tue Nguyen, Yip, S.; Wolf, D. (Argonne National Lab., IL (USA)). Aug 1987. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88002955/JAW.

From Conference on interface science and engineering; Lake Placid, NY, USA (12 Jul 1987).

A new molecular dynamics program for the investigation of planar bicrystalline interfaces at high temperature and finite external stress has been developed. The constant-stress (Parrinello-Rahman) method is combined with a Region I-Region II treatment of the borders, thus avoiding (1) 3d-periodic border conditions (and therefore the presence of two interfaces in the computational unit cell) and (2) unphysical constraints arising from fixed borders. The usefulness of this new "semi-periodic border" treatment is illustrated in an investigation of the high-temperature stability and structure of the $\Sigma = 29$ (100) twist grain boundary. 7 refs., 5 figs.

13511 **(CONF-870873—23) Effect of the subgap conductance on the metastable states in a Josephson tunnel junction.** Cristiano, R.; Pagano, S.; Silvestrini, P.; Gray, K.E.; Liengme, O. (Consiglio Nazionale delle Ricerche, Naples (Italy). Ist. di Cibernetica; Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 3p. NTIS, PC A02. Order Number DE88003102/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

An investigation of the decay rate of metastable states in Josephson tunnel junctions in presence of thermal noise is presented. We have observed that, in the extremely underdamped regime, there is an exponential temperature dependence of the best fit value for the shunt conductance. Such a dependence shows a close relation with the temperature dependence of the subgap conductance, suggesting that the effective conductance for the escape from the metastable states obeys to a quasi-particle thermal activation mechanism. The introduction of this effective conductance into the lifetime expression for the zero-voltage states leads to significant changes in the width of the switching current distributions. A comparisons of the experimental data with the proposed model is reported. 7 refs., 2 figs.

13512 (CONF-8705194—4) Techniques for the detection of photodesorbed negative ions. Young, C.E.; Schweitzer, E.L.; Pellin, M.J.; Gruen, D.M.; Hurych, Z.; Soukiassian, P.; Bakshi, M.H.; Bommannavar, A.S. (Argonne National Lab., IL (USA); Northern Illinois Univ., Dekalb (USA). Dept. of Physics). 1987. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003123/JAW.

From 3. international workshop on desorption induced by electronic transitions; Shelter Island, NY, USA (20 May 1987).

This paper reports the direct observation of H^- ions released from a Cs-dosed W(100) crystal by photon-stimulated desorption (PSD). This study utilized the 3m toroidal grating monochromator beamline at the University of Wisconsin-Madison Synchrotron Radiation Center. The main technical problem to be overcome in such experiments is the large background from photoemitted electrons which dominate the weak anion signal by many orders of magnitude. The solution ultimately employed utilized both magnetic suppression of photoelectrons and time-of-flight (TOF) mass separation. No internal modifications to the basic cylindrical mirror analyzer (CMA) were required. We are not aware of any previous reports of the detection of negative ions released from surfaces via photon bombardment, with the exception of high flux laser experiments, in which plasma formation is involved in the ionization process. 16 refs., 3 figs.

13513 (CONF-8710159—4) Numerical solutions of two moving boundary problems by both finite difference and finite element methods with applications. Hassanein, A.M. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002867/JAW.

From 12. international conference on atomic collisions in solids; Okayama, Japan (12 Oct 1987).

The time dependent heat conduction equation that is solved in different coordinate systems is solved subject to various boundary conditions. Boundary conditions include surface heat flux, energy to vaporization of target materials, radiation from surface to surrounding, and possible phase change of material. This system of equations is subject to two moving boundaries. One moving boundary being the melt-solid interface because the surface heat flux may result in melting the surface of the exposed material. Another moving boundary is the receding surface as a result of evaporation of the wall material due to the continuous heating of the melted surface. Finite difference and the finite element methods are used and compared in such solution to these problems. Physical applications to these problems include high energy deposition from electron or ion beams interaction with materials for space and weapons applications, plasma disruption and energy dump on the walls or components of a fusion reactor, and high energy laser welding and annealing of materials. 23 refs., 3 figs.

13514 (DOE/ER/45275—1) Surface and interface electronic structure: First year progress report. Kevan, S.D. (Oregon Univ., Eugene (USA)). 1987. Contract FG06-86ER45275. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003363/JAW.

This progress report discusses the work done at the Materials Science Institute in the following areas: anomalous surface state decay lengths and surface electronic structure of tungsten. 2 figs. (LSP)

13515 (EFI—892(43)-86) Influence of incoherent multiple scattering on the radiation frequency spectrum of relativistic particles at their planar channeling in crystals. Avakyan, A.R.; Yung, C. (Erevanskij Fizicheskij Inst. (USSR)). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700960/JAW.

It is shown that when calculating the characteristics of radiation of particles at planar channeling in already not too thick crystals, one should not only take into account the change in the particle distribution over transverse energies ϵ/sub perpendicular/, which is due to incoherent multiple scattering, but also the change in the corresponding radiation characteristics at a given ϵ/sub perpendcular/. With such more thorough regard for the incoherent scattering effect, the maxima of frequency spectra of the channeled particles must shift to a softer region. In case of positrons this shift is especially significant. 11 refs.; 1 tab.

13516 (FEI—1772) Study of point defects in beryllium by Moessbauer spectroscopy. Bogdanov, V.V.; Bykov, V.N.; Zakurkin, V.V.; Klochko, G.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701007/JAW.

Reduction of beryllium (with addition of iron-57 isotope) irradiated by electrons at 120 and 160 K was investigated for the first time by Moessbaner spectroscopy. Three regions of thermal stability of defect-impurity complexes of different nature were distinguished when analyzing evolution of resonance spectra during postradiation annealings: 120-160 K, 160-240 K, 240-300 K. Possible mechanisms of defect structure reconstruction using the ideas of two configurations of host interstitial atoms, differing by the energy of migration activation were discussed. 7 refs.; 2 figs.

13517 (FEI—1796) On estimators of ranges for linear functionals when simulating an equation of radiation transport with inhibition of a leakage. Blyskavka, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701015/JAW.

A general statement of unbiased estimations of ranges for linear functionals of collision density when simulating the equation of radiation transport in a finite region with inhibition of a leakage is given. 3 refs.

13518 (IAE—4182/11) Computerized simulation of pipe diffusion of intrinsic interstitial atom. Kolomytkin, V.V.; Kevorkyan, Yu.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701024/JAW.

Using computerized simulation, the possibility of accelerated migration of intrinsic intestitial atom (IIA) along the nucleus of edge dislocation [100] (010) in α-Fe is investigated. A barrier for IIA migration is detected along the dislocation axis, which exceeds by a factor of > 6 migration energy in the perfect lattice. Stable configurations of IIA in dislocation nucleus, which could play the role in accelerated pipe diffusion, are found. However, no continuous chain of simplified pitches of IIA migration between these configurations is detected. 17 refs.; 3 tabs.

13519 (IAE—4323/11) Effect of load on radiation-induced point defect annihilation by dislocation. Kolomytkin, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701026/JAW.

Instability zones of radiation-induced point defects near the edge dislocation [100] (010) in α iron have been determined both for a crystallite unloaded and uniaxially loaded (along the Burgers vector) up to 2.5% deformation. Method of molecular dynamics with artificial energy dissipation was used for calculating atomic configurations. Preference factor has been evaluated from the obtained data on instability zones. 17 refs.; 5 tabs.

13520 (IAE—4324/11) Does the pipe diffusion of self-interstitials in crystals under stresses exist. Kolomytkin, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701027/JAW.

Migration of self-interstitials (SI) along nucleus of edge dislocation [100] (010) in uniaxially loaded (along Burgers vector) α-iron crystallite has been investigated. Method of molecular dynamics with artificial energy dissipation was used to determine migration energies. No accelerated SI pipe diffusion either in the center

or in "a near-surface" layer of a dislocation pipe up to 2.5% tensile deformation has been discovered. 7 refs.

13521 **(IAE—4363/11) Expansion of diamond versus irradiation time.** Gordeev, V.G.; Nikolaenko, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701033/JAW.

Experimental data on diamond expansion under neutron irradiation are given. Two expansion stages have been investigated for 70-100 deg C irradiation temperature - in crystalline state and during amorphization. Effect of neutron flux on the nature of diamond expansion depending on neutron fluence has been analysed. Mutual effect of the production rate of disturbances and their annealing including disturbances due to gamma irradiation has been investigated. Dependence of diamond expansion on the irradiation time at different neutron fluxes is given as well. 4 refs.; 4 figs.

13522 **(IAE—4365/11) Study of cascade mechanism of nucleation of vacancy clusters in metals by computerized simulation.** Kapinos, V.G.; Osetskij, Yu.N.; Platonov, P.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701035/JAW.

Simulation of a nucleation process in fcc metal (using copper as an example) deleted zones of large vacancy clusters by an electron microscope has been performed. Conditions, under which the deleted zone is capable to transform to the Frank vacancy loops or to tetrahedrons from packing defects, have been investigated. The data obtained permit to explain experimental results on temperature dependence of a copper microstructure irradiated at temperatures < 60 K. 22 refs.; 7 figs.

13523 **(IAE—4376/11) Use of long-distance pair potentials in calculations of defect characteristics in metals.** Kapinos, V.G.; Osetskij, Yu.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701039/JAW.

Dependence of monovacancy formation energy in sodium, α iron and copper from interatomic potential cutting radius was investigated by the method of static simulation. Investigational results permitted to develop a calculation technique of radiation-induced defects in metals using pair potentials obtained from pseudopotential theory. The technique has been tested in calculations of self-interstitial formation energy in α iron and vacancy complexes in α iron and copper. 16 refs.; 4 figs.; 8 tabs.

13524 **(INIS-BR—909) About relation between mass absence and gap in the lattice gauge theories.** Barata, J.C.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 120p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701072/JAW.

The absence of electric charge in a dipole state, with limited energy, in a U(1) lattice gauge theory with scalar matter field, in the 'screening-confinement' region of the phase diagram of the theory, in the limit in which we take one of the constituent particles to infinity, is studied. It contains an introductory part, an apendix on polymer expansions and a review of results on changed states in the Z/sub 2/ model

13525 **(INIS-SU—2/1) Volume and surface magnetoplasma polaritons in semiconductor layer.** Beletskij, N.N.; Glukhov, O.V. (AN Ukrainskoj SSR, Kharkov. Inst. Radiofiziki i Ehlektroniki). 1986. 26p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701087/JAW.

New features in propagation of plasma polaritons in a plane layer of magnetoactive semiconductor plasma with symmetric and non-symmetric dielectric environment have been studied. Dispersion and polarization characteristics of magnetoplasma oscillations at different values of boundary medium parameters have been found. Qualitaive criteria of resonance interaction of surface magnetoplasma polaritons have been determined propagating on the opposite boundaries of a semiconductor sample. Plasma waves in the semicnductor magnetoactive layer boundaring with a dielectric of finite thickness have been investigated. 12 refs.; 13 figs.

13526 (INIS-SU—431, pp 543) **Determining the sign and temperature dependence of superfine magnetic field on /sup 181/Ta nuclei in LuFe/sub 2/.** Kochetov, O.I.; Komissarova, B.A.; Krylov, V.I.; Muminov, A.I.; Sazhinski, Ya.; Sorokin, A.A.; Tsupko-Sitnikov, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13527 (INIS-SU—431, pp 544) **Identification of a metastable magnetic state in GdFe/sub 2/ by superfine interaction of /sup 181/Ta nuclei.** Aksel'rod, Z.Z.; Komissarova, B.A.; Kochetov, O.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13528 (INIS-SU—431, pp 560) **Positron annihilation and phase transformation in alloys of In-Tl system.** Baturin, A.A.; Shabalovskaya, S.A.; Lotkov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13529 (INIS-SU—431, pp 572) **Positronium diagnostics of phase transitions of TiNi based alloys.** Shabalovskaya, S.A.; Baturin, A.A.; Lotkov, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13530 (INIS-SU—431, pp 591) **Positron annihilation on A-centers in silicon.** Prokop'ev, E.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13531 (INIS-SU—431, pp 399) **Irreversible transition from shadow effect to a channeling for the ions scattered on Ge monocrystal.** Karamyan, S.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13532 (INIS-SU—431, pp 413) **Computerized simulation of coherent Coulomb excitation of relativistic nuclei in crystals.** Shirokov, A.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13533 (INIS-SU—431, pp 552) **X-ray spectroscopic analysis with ion microprobe.** Immel', A.R.; Puzyrevich, A.G.; Ryabchikov, A.I.; Shipilov, A.L.; Yanovskij, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13534 (INIS-SU—431, pp 573) **Positron annihilation centers in potassium bromide monocrystals irradiated by charged particles in the 300-520 K temperature range.** Annenkov, Yu.M.; Chormonov, A.B. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13535 (INIS-SU—431, pp 576) **Damage profile in GaP implanted by high-energy ions.** Asheron, K.; Otto, G.; Flagmajer, R.; Tsshau, Kh.Eh.; Bugrov, V.N.; Karamyan, S.A. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13536 (INIS-SU—431, pp 578) **Nuclear spectroscopic determination of cross sections of (np) and (nα) reactions on magnesium isotopes.** Gopych, P.M.; Demchenko, M.N.; Zalyubovskij, I.I.; Kizim, P.S.; Sotnikov, V.V.; Shus', A.F. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13537 (INIS-SU—431, pp 579) **Study of gallium phosphide complex by positron annihilation.** Grigoryan, N.E.; Opilat, V.Ya.; Tartachnik, V.P.; Tychina, I.I.; Khvostov, D.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13538 (INIS-SU—431, pp 580) **Study of positron annihilation in cadmium diphosphide contained high concentration of radiation-induced defects.** Kosyak, S.B.; Litovchenko, P.G.; Megela, I.G.; Sokolov, A.M.; Tartachnik, V.P.; Tychina, I.I. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13539 (INIS-SU—431, pp 584) **Defect activation energy dose dependence under γ-quantum effect on silicon crystals.** Filipenko, L.A.; Koroteev, Yu.M. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13540 (INIS-SU—431, pp 593) **Effect of defects on perturbed angular correlation in Li/sub 2/HfO/sub 3/.** Georgiev, A.K.; Misheva, M.A.; Tumbev, G.Kh. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13541 (INIS-SU—431, pp 594) **Angular and charge distributions of matter sputtered from transuranium compound targets in nuclear-physical experiments.** Tsepelevich, S.O.; Baranov, I.A.; Obnorskij, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88780039/JAW. (CONF-8704221—).

From 37. All-Union conference on nuclear spectroscopy and nuclear structure; Yurmala, USSR (14 Apr 1987).

13542 (JINR-R—14-86-694) **Phonon spectra of ordered and disordered phases of MBBA.** Belushkin, A.V.; Natkanets, I.; Simkin, V.G.; Dolganov, V.K. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Neutron Physics; AN SSSR, Chernogolovka. Inst. Fiziki Tverdogo Tela). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1986. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701188/JAW.

Submitted to the journal Mol. Cryst. Liq. Cryst. .

The spectra of inelastic incoherent neutron scattering (IINS) in the methoxy-benailidene-butylaniline (MBBA) have been measured with the simultaneous phase control of the sample using the neutron diffraction (ND). The experiments were carried out in the nematic liquid crystal state (NLC) at T=300 K as well as in seven solid modifications in the temperature range from 90 to 290 K. The variety of polymorphous transformations in the MBBA (an amorphous state C/sub 0/, two disordered solid state mesophases C/sub 1/ and C/sub 2/, four ordered crystalline phase C/sub 3/, C/sub 4/, C/sub 5/, C/sub 6/) enabled us to trace the transformation of the vibrational spectrum at the transition from amorphous into crystalline state. For solid state modifications the weighted density of phonon states has been obtained. In the disordered phases (C/sub 0/ and C/sub 1/) as compared with the crystalline ones the Debye approximation is applicable for a narrower frequency range, and an increasing excess of the phonon density of state is observed in the low frequency range. 10 refs.; 9 figs.

13543 (LYCEN-T—8657) **Experimental and theoretical study of directional effects on radiation and pair creation in crystal at energies near 100 GeV.** Belkacem, A. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Jul 1986. 221p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88751424/JAW.

We investigated the electron-positron pair production from incident photons on a thin crystal. When the photon energy is higher than about 30 GeV, the pair production rate from a photon beam aligned along a crystal direction is higher than the rate measured with an amorphous target (Bethe-Heitler value). In contrast with what was observed for a random orientation (or with an amorphous target) the pair production rate increases sharply with the photon energy. We also investigated the radiation emitted by high energy electrons and positrons (70-200 GeV) along a crystal direction. The intensity of the radiation was found to be extremely high. The increase of the intensity of these two electromagnetic processes (radiation and pair creation) was still observed for incident angles much larger than the channeling critical angle. Thus, a theory based on the channeling phenomenon is not able to explain such observations. In order to understand these new phenomena we developed a new theoretical approach based on the electromagnetic interaction in strong fields. The predictions of this theory on the pair production are in very good agreement with the measurements. The calculations of the radiation are in quantitative agreement with measurements for incident angles larger than the channeling critical angle. This agreement is only qualitative for incident angles smaller than the critical angle.

13544 (PSD—87, pp I16) **Point defects in GaP single crystals investigated by mechanical damping.** Klimm, D.; Paufler, P. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Sektion Chemie). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13545 (PSD—87, pp I22) **Positron annihilation study of defects and microheterogeneity of chalcogenide glassy semiconductors.** Shantarovich, V.; Kobrin, B.; Kevdina, I. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13546 (PSD—87, pp I23) **Effect of annealing on annihilation site in amorphous structures.** Malhotra, L.K.; Vijay, Y.K.; Jain, I.P. (Rajasthan Univ., Jaipur, India. Dept. of Physics; Rajasthan Univ., Jaipur, India). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13547 (PSD—87, pp I25) **Positron studies of defects in PbTe.** Dlubek, G.; Krause, R.; Muehlberg, M.; Schenk, M. (Paedagogische Hochschule N.K. Krupskaja, Halle, German Democratic Republic. Sektion Mathematik/Physik; Martin-Luther-Universitaet Halle-Wittenberg, Halle, German Democratic Republic. Sektion Physik; Humboldt-Universitaet, Berlin, German Democratic Republic. Sektion Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13548 (PSD—87, pp J1) **Defect profiling in ion-implanted silicon with slow positrons.** Maekinen, J.; Lahtinen, J.; Vehanen, A.; Hautojaervi, P.; Huomo, H. (Helsinki Univ. of Technology, Espoo, Finland. Lab. of Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13549 (PSD—87, pp J2) **Slow positron study of GaAs crystals.** Saarinen, K.; Hautojaervi, P.; Huomo, H.; Huttunen, P.; Vehanen, A. (Helsinki Univ. of Technology, Espoo, Finland. Lab. of Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13550 (PSD—87, pp J3) **Slow positron study of defects in thin metal films evaporated on metal substrates.** Huttunen, P.; Maekinen, J.; Vehanen, A.; Hautojaervi, P. (Helsinki Univ. of Technology, Espoo, Finland. Lab. of Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13551 (PSD—87, pp J4) **Vacancy formation energy near Al(110) surface measured with slow positrons.** Huomo, H.; Vehanen, A.; Hautojaervi, P.; Bentzon, M.D. (Helsinki Univ. of Technology, Espoo, Finland. Lab. of Physics; Technical Univ. of Denmark, Lungby. Lab. of Applied Physics II). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13552 (PSD—87, pp J7) **Positron lifetime study of hafnium nitride films.** Brunner, J.; Perry, A.J. (Eidgenoessische Technische Hochschule, Zurich, Switzerland. Lab. fuer Festkoerperphysik; GTE Valeron Corp., Troy, Michigan, USA). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13553 (PSD—87, pp J8) **Sensitivity of positron defect detection of surface layers.** Arifov, P.U.; Shevchenko, A.V. (AN Uzbekskoj SSR, Tashkent. Inst. Ehlektroniki). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13554 (PSD—87, pp J9) **Study of thin copper films using angular correlation technique.** Aravin, L.G.; Novikov, Yu.A.; Filimonov, M.K.; Shantarovich, V.P. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13555 (PSD—87, pp K1) **Positron annihilation lifetime measurements in gamma-irradiated quartz.** Hsu, F.H.; Mallard, W.C.; Inya, M.I. (Georgia State Univ., Atlanta, USA. Dept. of Physics and Astronomy). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13556 (PSD—87, pp K2) **Positron annihilation studies in undoped and hydrogen doped MgO crystals thermochemically reduced.** Pedrosa, M.A.; Pareja, R.; Gonzalez, R.; Chen, Y. (Universidad Complutense de Madrid, Spain. Facultad de Ciencias Fisicas; Oak Ridge National Lab., TN, USA). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13557 (PSD—87, pp K3) **Study of valent states of transition metal ions at the surface of complex compounds by positron diagnostic methods.** Ilyasov, A.Z.; Mikhailin, A.V. (AN Uzbekskoj SSR, Tashkent. Inst. Ehlektroniki). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13558 (PSD—87, pp K4) **Positron annihilation in the high intensively irradiated alkali halides.** Annenkov, J.; Chormonov, A. (Tomskij Politekhnicheskij Inst., USSR). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13559 (PSD—87, pp K5) **Positron bound state in the vacancies in alkali halides.** Nurmagambetov, S. (Tomskij Politekhnicheskij Inst., USSR). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13560 (PSD—87, pp K6) **Positron annihilation irregularity in BaF/sub 2/.** Elefteriades, C.; Chardalas, M.; Dedoussis, S.; Charalambous, S. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13561 (PSD—87, pp K7) **Dependence of positron capture rate on dislocation density in solid solution of KCl-KBr.** Dhanalakshmi, S.R.; Nagarajan, T.; Ramasamy, S. (Madras Univ., India). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13562 (PSD—87, pp K8) **Positron studies of BaTiO/sub 3/.** Marx, U. (Martin-Luther-Universitaet Halle-Wittenberg, Halle, German Democratic Republic. Sektion Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13563 (PSD—87, pp K9) **Sintering and crystallization of titanium containing lead borate glasses.** Brauer, G.; Boden, G.; Huebert, T.; Kirsch, M. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic; Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Anorganische Chemie). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13564 (PSD—87, pp L1) **Plastic crystals bicyclooctane and norbornylene studied by positron annihilation.** Eldrup, M.; Lightbody, D.; Sherwood, J.N. (Risoe National Lab., Roskilde, Denmark; Strathclyde Univ., Glasgow, UK). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13565 (PSD—87, pp L2) **Positron lifetime studies of X-irradiated N-acetyl-D,L-alanine.** Walker, W.W. (Alabama Univ., University, USA. Dept. of Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13566 (PSD—87, pp L3) **Positron lifetime studies of organic coatings.** Szeles, C.; Suevegh, K.; Vertes, A.; White, M.; Leidheiser, H. (Eoetvoes Lorand Univ., Budapest, Hungary. Lab. of Nuclear Chemistry; Lehigh Univ., Bethlehem, PA, USA). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13567 (PSD—87, pp L5) **Positron lifetime in mordenite impregnated with gold.** Abbe, J.C.; Debowska, M. (Wroclaw Univ., Poland). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13568 (PSD—87, pp M3) **Line shape parameters from 2-d angular correlation distributions.** Alam, A.; West, R.N. (Ulster Univ., Coleraine, UK. Dept. of Physics; East Anglia Univ., UK. School of Mathematics and Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13569 (PSD—87, pp I15) **Ion bombardment induced changes in microhardness of GaP.** Ascheron, C.; Otto, G.; Neumann, H.; Dlubek, G.; Krause, R.; Karamyan, S.A.; Bugrov, V.N. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Sektion Physik; Martin-Luther-Universitaet Halle-Wittenberg, Halle, German Democratic Republic. Sektion Physik; Joint Inst. for Nuclear Research, Dubna, USSR). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13570 (PSD—87, pp I18) **Near-edge optical properties of proton and helium implanted InP single crystals.** Hoerig, W.; Orlenko, V.F.; Neumann, H.; Ascheron, C. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Sektion Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13571 (PSD—87, pp I19) **Structure-antistructure disorder: a homogeneous model for the explanation of optical properties of irradiated GaAs and InP.** Unger, K.; Pasemann, L. (Karl-Marx-Universitaet, Leipzig, German Democratic Republic. Sektion Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).

13572 **Polaron in n dimensions.** Sernelius, B.E. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review* [*Section*] *B: Condensed Matter;* **36**: No. 17, 9059-9067(15 Dec 1987). Contract AC05-84OR21400.

The energy dispersion for arbitrary momentum of a polaron in n dimensions is calculated by the Rayleigh-Schroedinger perturbation theory and by a modified Brillouin-Wigner perturbation theory. For the energy and effective mass of the polaron ground state, both methods give results that agree with the results of V. V. Paranjape and P. V. Panjat [Phys. Rev. B 35, 2942 (1987)] to linear order in the polaron coupling constant α. The self-energy shifts are progressively weakened with increasing dimension. In particular, this weakening occurs for the structure in the energy dispersion near the momentum value at which the polaron starts decaying via the emission of phonons.

13573 **Angular momentum branching ratios for electron-induced ionization: Atomic and model calculations.** Mehl, M.J.; Einstein, T.L. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physical Review* [*Section*] *B: Condensed Matter;* **36**: No. 17, 9011-9024(15 Dec 1987).

We present calculations of the matrix elements for electron-induced ionization of core electrons of atoms. We use both self-consistent atomic potentials for accuracy and model potentials to gain physical insight. We pay particular attention to the angular momentum distribution of the two final-state electrons, especially when one of them lies near what would be the Fermi energy in a solid (i.e., as in an absorption fine-structure experiment). For nodeless core wave functions, in the dominant channel both final-state electrons have angular momentum one greater than that of the initial core state. For sufficiently deeply bound states, this first approximate selection rule holds until the incident electron energy exceeds the ionization threshold by at least 500 eV, i.e., over the experimentally relevant range. It is also possible to determine the angular momentum distribution of the final-state electron. The EXAFS-like electron tends to have angular momentum one greater than that of the initial core state, even in some cases where the first approximate selection rule does not hold. (EXAFS is extended x-ray-absorption fine structure.) The strongest trend is that the dipole component in a partial-wave expansion of the Coulomb interaction dominates the matrix element. In these studies, careful treatment of not just the core state but also the unbound states is crucial; we show that the conventional orthogonalized plane-wave approximation is inadequate, giving incorrect ordering of the channels. For model potentials with an adjustable screening length, low-lying bound resonances are found to play an important role.

13574 **Observation of direct multiquantum vibrational excitation in gas-surface scattering: NH_3 on Au(111).** Kay, B.D.; Raymond, T.D.; Coltrin, M.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **59**: No. 24, 2792-2794(14 Dec 1987). Contract AC04-76DP00789.

Vibrationally excited NH_3 molecules are observed in the scattering of NH_3 (v = 0) from Au(111). We observe up to three quanta of vibrational excitation in the ν_2 "umbrella" vibrational mode of NH_3. The vibrational excitation probability scales linearly with the kinetic energy of the incident beam above a threshold energy corresponding to the quanta excited, and is independent of the surface temperature, T/sub s/, over the range 300 K≦T/sub s/≦800 K. These results are discussed in terms of an electronically adiabatic collisional mechanism for vibrational excitation.

13575 **Stability of the dense radial morphology in diffusive pattern formation.** Grier, D.G.; Kessler, D.A.; Sander, L.M. (Physics Department, University of Michigan, Ann Arbor, Michigan 48109-1120). *Physical Review Letters;* **59**: No. 20, 2315-2318(16 Nov 1987).

The dense radial structure is a distinct morphology which develops in many diffusive pattern-forming systems. We propose the first model to explain the stability of this structure. Stability arises in this model from the resistivity of the growth channels, which has been neglected in previous analyses. We also report excellent agreement between the predictions of our model and experimental results from two-dimensional electrochemical deposition.

13576 **Density-functional theory in strong magnetic fields.** Vignale, G.; Rasolt, M. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6032). *Physical Review Letters;* **59**: No. 20, 2360-2363(16 Nov 1987). Contract AC05-84OR21400.

We formulate the current-density—functional theory for systems in arbitrarily strong magnetic fields. A set of self-consistent equations comparable to the Kohn-Sham equations for ordinary density-functional theory is derived, and proved to be gauge invariant and to satisfy the continuity equation. We prove that the exchange-correlation energy functional E/sub xc/[n,j/sub p/] [n(r) is the density and j/sub p/(r) is the "paramagnetic" current density] depends on the current via the combination $\nu(r)$ = del x [j/sub p/(r)/n(r)]. An explicit formula for E/sub xc/ is derived, which is local in $\nu(r)$.

13577 **Bulk and surface diffusion of heavy particles in metals: A path-integral approach.** Sols, F.; Guinea, F. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 and Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **36**: No. 15, 7775-7785(15 Nov 1987). Contract AC05-84OR21400.

The dynamics of a particle interacting with the electrons of a metal and moving through a lattice has been investigated. A scaling scheme based on a path-integral formulation of the problem is given which is valid for a wide range of couplings. We obtain numerical estimates for the importance of the coupling for charged particles moving within the bulk of metals or at their surfaces. Particles of charge one have couplings which lie below the threshold for self-trapping, although their values are large enough to ensure a significant influence on their dynamics at low temperatures. Finally, it is shown that a transition to a self-localized situation is in principle possible, and may be of relevance to situations where the screening cloud is slow enough as compared with the dynamics of the external particle.

13578 **Quantum electron glass.** Vignale, G. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] B: Condensed Matter;* **36**: No. 15, 8192-8195(15 Nov 1987).

A model of localized interacting electrons is studied numerically, under conditions in which the electron wave functions significantly overlap in space. A Coulomb gap in the one-particle density of states is found to persist throughout the localized regime. From the calculated rise of a quantum-mechanical order parameter, and from the increase in the number of metastable "pseudoground" states, evidence is obtained of a glass transition, occurring at zero temperature, as the overlap is varied.

13579 **Existence of Wannier-Stark localization.** Emin, D.; Hart, C.F. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **36**: No. 14, 7353-7359(15 Nov 1987). Contract AC04-76DP00789.

The eigenstates of an electron in an arbitrarily long periodic chain under the influence of an applied electric field are determined. The interaction of the electron with the electric field is divided into two components. The first component has the lattice periodicity and is incorporated into the system's periodic potential. It describes the electric-field-induced alteration of each of the periodic potential wells. The second component, a nonperiodic steplike function, is shown to have vanishing interband matrix elements. Indeed, it produces Wannier-Stark localization with its eigenvalues yielding Wannier-Stark ladders. Thus it is shown that the Wannier-Stark localization survives consideration of multiple electronic energy bands.

13580 **Nontransferable van der Waals potentials: Insulators at high pressure.** Maggs, A.C.; Ashcroft, N.W. (Laboratory of Atomic and Solid State Physics, Clark Hall, Cornell University, Ithaca, New York 14853-2501). *Physical Review [Section] B: Condensed Matter;* **36**: No. 14, 7586-7589(15 Nov 1987).

For a simple model whose cohesion is dominated by dispersion forces we show that the expansion of the energy in terms of multicenter interactions is ill conditioned at a low density. This density is physically realizable for systems with highly polarizable atoms, and in these circumstances an alternative expression for the internal energy is required. For polarizable systems the requisite densities are readily achievable with the use of modern high-pressure capabilities and have consequences for the interpretation of equation-of-state data in terms of potential-energy functions.

6561 Superconductivity

REFER ALSO TO CITATION(S) 11788, 11832, 11856, 11857, 11858, 11859, 11860, 11861, 11863, 11874, 11883, 11884, 11897, 11949, 13511, 13754

13581 **(CONF-8706237—2) The physics of metallic superlattices: An experimental point of view.** Schuller, I.K. (Argonne National Lab., IL (USA)). Jul 1987. Contract W-31109-ENG-38. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003080/JAW.

From NATO advanced study institute on physics, fabrication, and applications of multilayered structures; Ile de Bendor, France (22 Jun 1987).

Experimental and theoretical data on metallic superlattices are presented. Topics discussed include electrical resistivity, superconductivity, elasticity, magnetic properties, coupling, thin film, interfacial and proximity effects. 23 refs., 17 figs., 3 tabs. (CBS)

13582 **(CONF-8707109—2) Structural relationships in high temperature superconductors.** Schuller, I.K.; Segre, C.U.; Hinks, D.G.; Jorgensen, J.D.; Soderholm, L.; Beno, M.; Zhang, K. (Argonne National Lab., IL (USA)). Sep 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002924/JAW.

From Adriatico conference on high temperature superconductors; Trieste, Italy (6 Jul 1987).

The recent discovery of two types of metallic copper oxide compounds which are superconducting to above 90°K has renewed interest in the search for new high temperature superconducting materials. It is significant that both classes of compounds, La/sub 2-x/Sr/sub x/CuO/sub 4-y/ and $YBa_2Cu_3O_{7-\delta}$, are intimately related to the extensively studied perovskite family. Both compounds contain highly oxidized, covalently bonded Cu-O sublattices, however, they differ in geometry. In this paper we discuss the relationship of these features to the superconducting properties. 30 refs., 6 figs.

13583 **Effect of low dimensionality on the parameters of high Tsub(c) superconductors.** Kresin, V.Z.; Wolf, S.A. (Lawrence Berkeley Lab., CA, USA; Naval Research Lab., Washington, DC, USA). *Solid State Communications;* 63: No. 12, 1141-1143(Sep 1987).

A method of determining the values of main parameters such as the effective mass, the Fermi energy, and the coherence length of the new high Tsub(c) superconductors is developed. The method is based on specific heat data. The new Tsub(c) materials are low dimensional systems and this feature plays a crucial role in the analysis. The parameters are calculated for Lasub(2-x)Srsub(x)CuO/sub 4/, x approx. = 0.2. Particularly interesting is the small value of the Fermi energy.

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REFER ALSO TO CITATION(S) 12878, 12879, 12904

13584 **(CEAC-R—2-86) 70 years of the general theory of relativity.** Castro Diaz-Balart, F.; Cabezas Solorzano, R. (Comision de Energia Atomica, La Habana (Cuba)). Jun 1986. 50p. (In Spanish). (ININ—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88700784/JAW.

In view of the 70th anniversary of the discovery of the General Theory of Relativity, an analysis was made of the special and general theories. The basic postulates, their consequences in the formulation of the theories, the main results, some aspects related to the experimental verification and its applications are presented, as are some elements of the mathematical formalism of the theories, to facilitate the logical interrelationships between its results and consequences. 48 refs.

13585 **(DOE/ER/25033—1) Applied mathematics of transport theory: Technical [progress] report, March 15, 1987-November 15, 1987.** Greenberg, W.; Zweifel, P.F. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Center for Transport Theory and Mathematical Physics). 1987. Contract FG05-87ER25033. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88004098/JAW.

This progress report discusses research programs in transport theory. In particular, the research areas discussed are nonlinear kinetic equations, linear theory and specific transport models. (LSP)

13586 **(FEI—1776) Higher order Pade approximation applied to quantum asymmetric whell problem.** Gaj, E.V.; Gusejnov, M.A.; Rabotnov, N.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701009/JAW.

The higher order Pade approximation up to L=45 constructed by series coefficients of the recursive perturbation theory is used to calculate the proper values of the quantum asymmetric wheel energy. Solutions converging in all physically essential values of the perturbation parameter are obtained. Their pole structure reproduces satisfactorily the position of special points of the function being approximate. 9 refs.; 2 figs.

13587 **(IAE—4347/1) Chronometrically invariant formulation of electrodynamics equation.** Lyubimov, B.Ya.; Matveev, L.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701030/JAW.

Chronometrically invariant combinations of components for 4-tensor electrodynamic objects corresponding to the observed three-dimensional values are constructed. The Maxwell equations and material relations are descried by means of chronoinvariant differential operations. In general, the equation for fields contain acceleration and the angular velocity of a frame of reference. 3 refs.

13588 **(IFT-P—11/87) Perihelium shifts in central potentials.** Amorim, A.E.A.; Ferreira, P.L. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701047/JAW.

Motivated by the rigorous results on level ordering for arbitrary central potentials recently derived in the literature a classical treatment of the perihelium shifts is presented, based on the consideration of those orbits which lie in the vicinity of a circular orbit. The role played by the Laplacian of the potential is emphasized. By the same approach Bertrand's theorem is also discussed, in connection with Arnold's proof.

13589 **(IFVE-OTF—86-212) Introduction to classical mechanics of systems with constraints. Pt.1.** Razumov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701055/JAW.

Classical theory of mechanical systems with constraints is consistently considered. The following problems are treated in this paper. Lagrangian equations are derived. The connection of symmetry transformations with conserved quantities is demonstrated. Lagrangian and Hamilton's equations of motion for the system with nondegenerate Lagrangians are proved to be equivalent. Restrictions for the choice of noncanonical coordinates in the extended phase space are studied. One-parameter groups of time-dependent canonical transformations are considered.

13590 **(IFVE-OTF—86-213) Introduction to classical mechanics of systems with constraints. Pt. 2.** Razumov, A.V.; Solov'ev, L.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701056/JAW.

In this paper Lagrangians whose symmetry transformations include arbitrary functions on time are shown to be, with necessity, degenerate. The Hamiltonian formalism for mechanical systems with degenerate Lagrangians is presented. The algorithm of producing the constraints and the total Hamiltonian is described. The reduction of a Hamiltonian mechanical system to a surface in the extended phase space and application of Dirac brackets to calculate Poisson brackets of the reduxed system are considered. 1 fig.

13591 **(IFVE-OTF—86-214) Introduction to classical mechanics of systems with constraints. Pt. 3.** Razumov, A.V.; Solov'ev, L.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1986. 36p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701057/JAW.

For systems with second class constraints the reduced phase space is constructed. It is shown that physically equivalent points of the phase space for systems with first class constraints are connected by canonical transformations generated by linear combinations of the first class constraints. For every system with first class constraints a physically equivalent system with second class constraints is constructed. As an illustrative application of the theory the relativistic straightline string is considered. 48 refs.; 1 fig.

13592 **(IFVE-OTF—87-38) Relativistic theory of gravitation and criticism of GRT.** Logunov, A.A.; Loskutov, Yu.M.; Mestvirishvili, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701304/JAW.

This paper discusses two subjects: 1) inacceptability of General Relativity Theory (GRT) as a physical theory of gravity and 2) construction of the Relativistic Theory of Gravitation (RTG) possessing all the attributes of field theories. 26 refs.

13593 **(ITEF—15(1987)) Spin precession in stationary gravitational fields.** Voronov, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701107/JAW.

The Lorentz references obtained from the laboratory one by the Lorentz transformation without rotation are derived explicitly

for the Schwarzschild and Reissner-Nordstroem spaces. Due to this fact it becomes possible to calculate exactly the frequency of spin procession of a trial particle during its longitudinal motion. The coordinate transformation leading the Reissner-Nordstroem metrics to the "isotropic" view has been found. 17 refs.

13594 **(ITEF—45(1987)) Special relativity theory (one-dimensional case) without the postulate on the equality of directions.** Lyakhovitskij, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701368/JAW.

The consequences of giving up the postulate on the equality of positive and negative x axis directions are shown and analyzed for one-dimensional motion of inertial systems. The logic foundations of the theory, except the above postulate, coincide with those conventional a lead in particular (in the assumption of equality of positive and negative x axis directions) to the development of standard special relativity theory. The giving up of the above postulate results in the conclusion of the possibility of existence of different maximum velocities a and b, corresponding to motions in positive and negative x axis directions. The relativistic factor and the method of velocity composition, due to dependence on a and b, differ from those conventional, but transfer into them on the assumption of equality of directions along the x axis. 3 refs.

13595 **(ITEF—88(1987)) Many-dimensional anisotropic anharmonic oscillator.** Turbiner, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 48p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701371/JAW.

Precision calculation of energies of several first states at d=2 and first 17 states at d=3 has been performed within the framework of a unique method based on "nonlinearization" method for d-dimension anisotropic an harmonic oscillator. Spectrum behaviour within the limit d -> ∞ has been investigated and problems of the given approach accuracy have been studied. For the first time properties of nodal surfaces of the given task have been investigated. Routine perturbation theory in degrees of a perturbation parameter has been constructed for several first states. 14 refs.; 3 figs.

13596 **(ITEF—185(1986)) Multicontinuations method and strong regular perturbations of linear operators.** Stepanov, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701375/JAW.

The method of multicontinuations is suggested to solve the problems of obtaining nonperturbative results using perturbation theory. The property of strong regularity (c-regularity) of perturbations is introduced. Some classical theorems are shown to be stable for relatively restricted perturbations and valid for the property of perturbation insignificant amount is substituted by the c-regularity property. Interrelation between c-regularity and holomorphy of operator and form families is considered. 9 refs.

13597 **(JINR-E—2-87-18) Quantum-mechanical splitters: how one should understand them.** Exner, R.; Seba, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701142/JAW.

To describe quantum oscillations on metallic rings and similar effects, some authors introduced recently an ideal device which "splits" the electron wavefunction at the junction of three "wires". A proper quantum-mechanical treatment requires, however, that the splitting procedure is described by a Hamiltonian. In this letter, it is shown how this can be achieved in the framework of the selfadjoint-extensions theory. 11 refs.; 1 fig.

13598 **(JINR-E—5-86-687) Three-dimensional topological solitons in the lattice model of a magnetic with competing interactions.** Bogolyubskij, I.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701149/JAW.

Submitted to the journal Phys. Lett., A.

Topological solitons of the vector field s-vector(x-vector), s/sub a/s/sub a/=1, a=1,2,3 defined on the three-dimensional lattice are investigated. The method of successful local minimization of the energy E functional is used. In the model under investigation there are competing ferromagnetic and atiferromagnetic interactios of spin, localized in the cubic lattice sites. It has been obtained that the lattice topological charge (Hopf index H/sub l/) may change its value during the minimization process, but in the case of its conservation at H/sub l/not = 0, the evolution of initial spin distributions results in formation of stable solitons. Several distributions have been found. 9 refs.; 2 figs.

13599 **(JINR-R—2-86-323) Singular Lagrangians. Classical dynamics and quantization. Lectures for young scientists.** Nesterenko, V.V.; Chervyakov, A.M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1986. 101p. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number TI88701158/JAW.

The lectures are devoted to the classical and quantum dynamics of the systems described by singular (or degenerate) Lagrangians. The complete set of the Hamiltonian constraints is constructed in the framework of the Lagrangian formalism. The equations of motion in the phase space are derived by taking into account all the constraints in the theory. It is proved that the dynamic on the physical submanifold of the phase space has the Hamiltonian form. On lectures the second Noether theorem is widely used. On its basis the properties of the Poisson brackets of the primary constraints are investigated and the invariance of the Lagrangian constraints during evolution is proved. The setting of the Cauchy problem in the theories with singular Lagrangians is discussed. The quantization of the systems with constraints is carried out by the functional integration in the phase space. There is considered the most general case of the first class and the second class constraints with an explicit time-dependence. The gauge conditions may be noninvolutary and time-dependent. The material is illustrated by some examples (relativistic point particle, relativistic string, electromagnetic field, and Yang-Mills fields) Yang-Mills fields). 56 refs.

13600 **(JINR-R—4-86-696) Adiabatic representation of three-body problem in hyperspherical coordinates. Statement of the problem.** Vinitskij, S.I.; Kadomtsev, M.B. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Theoretical Physics; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1986. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701162/JAW.

Submitted to the journal J. Phys. B. .

For a three-body Coulomb problem a hyperspherical parametrization is given for independent variables on a five-dimensional sphere S/sup 5/ with a hyperradius R/sub H/, the first linear invariant of the tensor of inertia of three particles. The hyperspherical adiabatic basis is defined as a complete set of eigenfunctions and eigenvalues of the Hamiltonian angular part on the sphere S/sup 5/ for every fixed value of the slow variable R/sub H/. The partial wave analysis in the total momentum J representation allows us to separate three Euler angles and to reduce the hyperspherical problem on S/sup 5/ to a system of (J+1) two-dimensional problems. Classification is given of states of the hyperspherical adiabatic basis for small and large values of the hyperradius R/sub H/ and the logarithmic Fock singularity at the point of three-body collision is explicitly shown. The approach is assigned at computing the cross sections of mesic-atomic processes in the muon-catalysis problem. 5 refs.

13601 **(JINR-R—4-87-221) Coordinate-momentum probability operator for point particles in a stationary electromagnetic field.** Kuryshkin, V.V.; Entralgo, E. E. (Universitet Druzhby Narodov, Moscow, USSR; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Theoretical Physics). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701165/JAW.

The quantum-mechanical description with a joint coordinate-momentum probability density for any quantum state in the case of a system of potentially interacting point particles placed in an external stationary electromagnetic field is under consideration. There has been performed a construction of the coordinate-momentum probability operator which determins all the other quantum operators and provides a quantization invariant under gauge transformations of the electromagnetic potential. 4 refs.

13602 **(JINR-R—17-86-698) Bose-gas with two- and three-body interactions: evolution of the unstable bubbles.** Barashenkov, I.V.; Kholmurodov, Kh.T. (Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Computing Techniques and Automation; Tadzhikskij Gosudarstvennyj Univ., Dushanbe, USSR). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701190/JAW.

In the mean-field approximation the boson system with two-body attractive and three-body repulsive δ-function interactions reduces to the PSI/sup 3/-PSI/sup 5/ nonlinear Schroedinger equation: iPSI/sub t/+PSI/sub XX/+-PSI+PSIPSI/sup 2/-aPSI PSI/sup 4/=0, a>0. We have simulated numerically the evolution of the soliton-like "bubble in the condensate" solution to this equation, and here the results are reported. The static soliton is found either to decay or to grow without bounds depending on the choice of initial perturbation. As regards the travelling "bubble", the growth rate diminishes under velocity increase, and at high speeds the soliton represents a rather long-lived object. 8 refs.; 3 figs.; 1 tab.

13603 **(N—88-10495) Fronts propagating with curvature dependent speed: algorithms based on Hamilton-Jacobi formulations. Final report.** Osher, S.; Sethian, J.A. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Sep 1987. 54p. (NASA-CR—178382; ICASE—87-66; NAS—1.26:178382). NTIS, PC A04/MF A01.

New numerical algorithms are devised (PSC algorithms) for following fronts propagating with curvature-dependent speed. The speed may be an arbitrary function of curvature, and the front can also be passively advected by an underlying flow. These algorithms approximate the equations of motion, which resemble Hamilton-Jacobi equations with parabolic right-hand-sides, by using techniques from the hyperbolic conservation laws. Non-oscillatory schemes of various orders of accuracy are used to solve the equations, providing methods that accurately capture the formation of sharp gradients and cusps in the moving fronts. The algorithms handle topological merging and breaking naturally, work in any number of space dimensions, and do not require that the moving surface be written as a function. The methods can be used also for more general Hamilton-Jacobi-type problems. The algorithms are demonstrated by computing the solution to a variety of surface motion problems.

13604 **(UCID—21280) Modification of the FEM3 model to ensure mass conservation.** Gresho, P.M. (Lawrence Livermore National Lab., CA (USA)). Jan 1987. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004722/JAW.

The problem of global mass conservation (lack thereof) in the current anelastic equations solved by FEM3 is described and its cause explained. The additional equations necessary to solve the problem are presented and methods for their incorporation into the current code are suggested. 14 refs.

13605 **(UCRL—15960-Pt.6) Advanced numerical modeling of microwave penetration and coupling for complex structures: Quarterly report No. 6, August 1986-October 1986.** Taflove, A.; Umashankar, K.R. (Northwestern Univ., Evanston, IL (USA). Dept. of Electrical Engineering and Computer Science; Illinois Univ., Chicago (USA). Communications Lab.). Nov 1986. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002666/JAW.

The goal of this research program is to develop theoretical and numerical models of microwave penetration and coupling for complex structures. These structures may have apertures, internal compartments, and wires of multi-conductor cable bundles. The basic methodology is the finite-difference time-domain (FD-TD) technique, developed under previous Air Force funding, and multi-conductor coupling analyses based upon either the integral equation approach or multi-conductor transmission line theory.

13606 **(UCRL—96136) Application of state-multipole Heisenberg equations to Raman excitation dynamics.** Shore, B.W.; Sacks, R.; Dixit, S.N. (Lawrence Livermore National Lab., CA (USA)). 10 Sep 1987. Contract W-7405-ENG-48. 46p. (CONF-8703217—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003828/JAW.

From International conference on multiphoton processes; Boulder, CO, USA (6 Mar 1987).

Description of detailed temporal excitation dyanmics for coherent excitation, such as is produced by idealized laser radiation, contrasts with evaluation of rate coefficients by means of generalized Golden Rule procedures; it requires an appropriate time-dependent Schroedinger equation. When the atom undergoing excitation is also affected by incoherent processes, such as collisions, this equation no longer suffices. The Heisenberg equations, or equivalent density-matrix equations, permit treatment in which coherence and incoherence play comparable roles in the excitation dynamics. Unlike rate equations, such equations must incorporate complexities that originate in the orientation degeneracy expressed by magnetic quantum numbers. In simple cases of coherent excitation, both for single-photon and multiphoton excitation, the sublevels merely require an average of 2J+1 independent Schroedinger equations. Relaxation couples the independent equations. It has been known for some time that appropriate state-multipole operators can simplify the description of many phenomena connected with optical pumping. This memo discusses application of these multipole operators to the description of Raman (or more general multiphoton) coherent excitation. In some simple limiting cases the equations simplify, but in general one has a hierarchy of coupled multipole polarizations and coherences in place of the populations and coherences that occur as variables in nondegenerate systems. 28 refs., 4 figs.

13607 **Phenomenological aspects of new gravitational forces. III. Slowly rotating astronomical bodies.** Nieto, M.M.; Macrae, K.I.; Goldman, T.; Hughes, R.J. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review [Section] D: Particles and Fields;* **36**: No. 12, 3694-3699(15 Dec 1987).

In this paper we expand the phenomenological quantum-gravity formalism developed previously and study the gravitational interaction of a slowly rotating body. We investigate in detail the β^2 effects of (the massive) vector and scalar partners of the graviton, as well as those due to standard tensor gravity. An application to Eoetvoes experiments shows that the vector and scalar coupling constants would have to be unexpectedly large for β^2 terms to account for postulated effects. We close with a short discussion on other possible applications.

13608 **Critical exponents for crisis-induced intermittency.** Grebogi, C.; Ott, E.; Romeiras, F.; Yorke, J.A. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physical Review [Section] A: General Physics;* **36**: No. 11, 5365-5380(1 Dec 1987).

We consider three types of changes that attractors can undergo as a system parameter is varied. The first type leads to the sudden destruction of a chaotic attractor. The second type leads to

the sudden widening of a chaotic attractor. In the third type of change, which applies for many systems with symmetries, two (or more) chaotic attractors merge to form a single chaotic attractor and the merged attractor can be larger in phase-space extent than the union of the attractors before the change. All three of these types of changes are termed crises and are accompanied by a characteristic temporal behavior of orbits after the crisis. For the case where the chaotic attractor is destroyed, this characteristic behavior is the existence of chaotic transients. For the case where the chaotic attractor suddenly widens, the characteristic behavior is an intermittent bursting out of the phase-space region within which the attractor was confined before the crisis. For the case where the attractors suddenly merge, the characteristic behavior is an intermittent switching between behaviors characteristic of the attractors before merging.

13609 **World-sheet action for the three-dimensional Ising model.** Orland, P. (Center for Theoretical Physics, Laboratory for Nuclear Science, Massachusetts 02139). *Physical Review Letters;* 59: No. 21, 2393-2396(23 Nov 1987).

The local complex action is found for a closed, interacting lattice string whose configurations generate the low-temperature graphs of the three-dimensional Ising model. This action depends upon Ising degrees of freedom on the surface, as well as its extrinsic curvature.

13610 **Conditions for absence of global SU(2) anomaly for four-dimensional gauge groups.** Okubo, S.; Geng, C.; Marshak, R.E.; Zhao, Z. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review* [*Section*] *D: Particles and Fields;* 36: No. 10, 3268-3272(15 Nov 1987).

Proofs are given group theoretically for the absence of the global SU(2) (Witten) anomaly for any compact Lie group $G \supset SU(2)$ satisfying $Pi_4(G) = 0$ (Pi_4 is the four-dimensional homotopy group). It is shown that the number of fermion zero modes is even for $G = SO(N)$ ($N \geq 7$) and the five exceptional groups G_2, F_4, E_6, E_7, and E_8. The absence of the Witten anomaly for the SU(N) ($N \geq 3$) groups requires freedom from the perturbative (triangle) anomaly.

13611 **Vacuum state and Schwarzschild solution in ten-dimensional gravity.** Wurmser, D. (Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, Maryland 21218). *Physical Review* [*Section*] *D: Particles and Fields;* 36: No. 10, 2970-2980(15 Nov 1987).

Gravity in more than four dimensions may involve terms of higher order in the curvature, as well as the linear terms present in ordinary general relativity. I explore the ten-dimensional vacuum configuration $M^4 \times S^6$. The ten-dimensional spherically symmetric potential is examined, and I determine conditions under which the formation of black holes is forbidden. Consequences for the stability of the vacuum are discussed.

13612 **Constructive methods for the ground-state energy of fully interacting fermion gases.** Aguilera Navarro, V.C.; Baker G.A. Jr.; Benofy, L.P.; Fortes, M.; de Llano, M. (Theoretical Division, Los Alamos National Laboratory, University of California). *Physical Review* [*Section*] *A: General Physics;* 36: No. 9, 4338-4347(1 Nov 1987).

A perturbation scheme based not on the ideal gas but on a system of purely repulsive cores is applied to a typical fully interacting fermion gas. This is "neutron matter" interacting via (a) the repulsive "Bethe homework-problem" potential, (b) a hard-core—plus—square-well potential, and (c) the Baker-Hind-Kahane modification of the latter, suitable for describing a more accurate two-nucleon potential. Pade extrapolation techniques and generalizations thereof are employed to represent both the density dependence as well as the attractive coupling dependence of the perturbation expansion. Equations of state are constructed and compared with Jastrow—Monte Carlo calculations as well as expectations based on semiempirical mass formulas. Excellent agreement is found with the latter.

13613 **Precausal quantum mechanics.** Bennett, C.L. (L-234, Lawrence Livermore Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *A: General Physics;* 36: No. 9, 4139-4148(1 Nov 1987).

It is pointed out that both classical Wheeler-Feynman electrodynamics and its finite quantized generalization inevitably lead to microscopic causality violation. As there is some evidence for such effects in proton Compton scattering, there is possibly reason to prefer such absorber theories of action at a distance over field theories as the more reasonable microscopic description of nature.

13614 **Geometrical phase factors and higher-order adiabatic approximations.** Nakagawa, N. (Ames Laboratory, Iowa State University, Ames, Iowa 50011). *Annals of Physics (New York);* 179: No. 1, 145-166(Oct 1987). Contract W-7405-ENG-82.

A detailed study of Schroedinger equations having several components with a time-dependent Hamiltonian is carried out, paying particular attention to the geometrical nature of these equations. Two features of such a study will be presented: (i) It is shown that the diagonalization process of such equations possesses a certain arbitrariness which can be interpreted precisely as a local gauge degree of freedom. For a two-component problem, this gauge symmetry structure is determined completely in terms of the corresponding geometrical structure, i.e., a differentiable principal fibre bundle equipped with a connection form. This geometrical structure, and particularly the notion of parallelism provided by it, is used subsequently to show that the wavefunction factorizes into two parts, one of which is thereby given a purely geometrical interpretation. (ii) Second, it is shown that the adiabatic theorem, well-known to hold in the extreme adiabatic limit, can be generalized in such a way that higher-order terms with respect to the adiabatic approximation can be calculated systematically. This part of the study is carried out for a reduced Schroedinger equation given subsequently after the aforementioned geometrical factorization. Clarification on how the combination of these two results allows one to study the now popular subject of "Berry's phase" for a wider class of systems than those in the earlier literature is given. Applications of the present result to certain systems, including the neutrino propagation in matter, are also discussed. copyright 1987 Academic Press, Inc.

13615 **Wave packets and WKB theory in phase space.** Littlejohn, R.G. (Dept. of Physics, Univ. of California, Berkeley, CA 94720). pp 8-13 of Statistical plasma physics: Proceedings of Workshop of US-Japan joint institute for fusion theory program. Nagoya, Japan; Institute of Plasma Physics (1986). (CONF-8602116—).

From US/Japan workshop on statistical plasma physics; Nagoya, Japan (17 Feb 1986).

A practical difficulty of traditional WKB theory is that it suffers from non-physical infinites at caustics. A theoretical difficulty is that it does not possess any resonable covariance or invariance properties under transformations in phase space. It turns out that the solution of one of these problems also solves the other, and leads to a version of WKB theory in phase space. The new theory is most easily implemented by using wave packets.

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 13147

13616 **(ORNL—6332) Fusion Energy Division annual progress report period ending December 31, 1986.** Morgan, O.B. Jr.; Berry, L.A.; Sheffield, J. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 444p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE88003651/JAW.

This annual report on fusion energy discusses the progress on work in the following main topics: toroidal confinement experiments; atomic physics and plasma diagnostics development; plasma theory and computing; plasma-materials interactions; plasma technology; superconducting magnet development; fusion engineering

design center; materials research and development; and neutron transport. (LSP)

7001 Plasma Research

REFER ALSO TO CITATION(S) 12972, 13453, 13513, 13615, 13739

13617 (AD-A—184986/8/XAB) Advanced concepts theory annual report, 1986. Memorandum report, January-December 1986. (Naval Research Lab., Washington, DC (USA)). 12 Aug 1987. 107p. (NRL-MR—6051). NTIS, PC A06/MF A01.

This report details the work of the Plasma Radiation Branch conducted in FY 86 with respect to several critical problems concerning the design of Z-pinch implosions and the optimization of their radiative output. Separate sections describe progress in atomic modeling of K-shell copper radiation, radiation hydrodynamics, argon implosions, design of anti-zippering nozzles, and analyses of anomalous resistivity and plasma opening switches.

13618 (AERE-R—12631) Charge transfer data for fusion plasmas. Greenland, P.T. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Jul 1987. 71p. H.M. Stationery Office, London, price Pound 6.00.

The report reviews charge transfer data of relevance to fusion plasmas physics. State selective charge capture from H(1s) by fully stripped He, C and O is discussed in detail and each of the reliably determined cross sections is fitted by a single functional form, over the entire energy range required both for plasma modelling and charge exchange spectroscopy. The He/sup 2+/ -Li single and double electron capture cross sections are reviewed. The limited data on charge capture by partially stripped technological metals such as Fe and Ni is discussed. Finally capture by impurity ions from excited hydrogen is considered, and it is shown that this can be an important process, particularly, in plasma with high electron density. The possibility of experiments at Asdex is considered.

13619 (CNIC—00038) Investigation of plasma equilibrium in HL-1 tokamak. Lu Zhihong; Jiang Yunxia; Yang Jinwei; Zhang Baozhu; Qiu Wei; Qin Yunwen. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 7p. (In Chinese). (SIP—0017). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700949/JAW.

In this paper, the plasma equilibrium in HL-1 tokamak has been discussed. The horizontal and vertical displacement of plasma is measured using a symmetical magneic probe system, and the temporal evolution of displacements is given by a data acquisition system with micro-computer. The influence of various stray fields on plasma equilibrium has been analysed. The direction and value of horizontal stray field induced by the totoidal field coils and primary windings are determined using vertical displacement data. By adjusting parameters of internal and external vertical field, in the flat part of discharge current, the plasma can be kept in its equilibuium state at the place where is 3 cm outer of chamber certre, i.e nearby the centre of limiter.

13620 (CNIC—00039) Preliminary results of MHD stability in HL-1 tokamak. Zheng Yongzhen; Ma Tengcai; Xiao Zhenggui Cai Renfang. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 11p. (In Chinese). (SIP—0018). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700950/JAW.

In this paper, MHD activities of HL-1 tokamak plasma are studied with Fourier transform and correlatio analysis. The poloidal modes m = 1, 2, 3,4 and toroidal modes n of MHD magnetic fluctuation signals are detected. Methods for suppressing MHD instabilities are suggested and tested, after MHD instabilities are studied in HL-1. The effects of MHD characteristics in the beginning stage of discharge on the whole process of discharge are analyzed. The disruption, in HL-1 device could be divided into three kinds: internal disruption, minor disruption and major disruption. The result shows that HL-1 will have a better operation condition if internal disruption appears. In is end, the stable operation region of HL-1 tokamak is also given.

13621 (CNIC—00040) Hydrogen atomic beam probe device for measuring plasma ion density. Liang Wenxue; Li Taihua; Zhang Jiquan; Diao Guangyue. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 10p. (In Chinese). (SIP—0019). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700951/JAW.

A hydrogen atomic beam probe device for measuring plasma ion density is described in this paper. It has many features, such as simple constructure, low equivalent intensity of neutral beam and a special Complex Faraday Cup. The measuring results of plasma ion density in a modelling plasma is presented. The result shows the ion density is increased as the discharge voltage increased. The acquisition and processing of the experimental data are completed by a on-line data analyzing system with a voltage waveform storage unit.

13622 (DOE/ER/53220—T4) Performance and optimization of direct implicit time integration schemes for use in electrostatic particle simulation codes. Procassini, R.J.; Birdsall, C.K.; Morse, E.C.; Cohen, B.I. (Lawrence Livermore National Lab., CA (USA)). [1988]. Contract FG03-86ER53220. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003254/JAW.

Implicit time integration schemes allow for the use of larger time steps than conventional explicit methods, thereby extending the applicability of kinetic particle simulation methods. This paper will describe a study of the performance and optimization of two such direct implicit schemes, which are used to follow the trajectories of charged particles in an electrostatic, particle-in-cell plasma simulation code. The direct implicit method that was used for this study is an alternative to the moment-equation implicit method. 10 refs., 7 figs., 4 tabs.

13623 (DOE/ET/51013—229-07/87) Advantages of using gyrotron scattering for alpha particle diagnostics. Woskoboinikow, P.P.; Cohn, D.R.; Machuzak, J.S.; Myer, R.C.; Rhee, R.Y. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Jul 1987. Contract AC02-78ET51013. 8p. (PFC/CP—87-12; CONF-8710140—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002590/JAW.

From 3. international symposium on laser-aided plasma diagnostics; Los Angeles, CA, USA (28 Oct 1987).

Millimeter-wave gyrotron collective Thomson scattering can be an effective diagnostic technique for the study of alpha particle behavior in ignited plasmas. The measurement of alpha particle density, velocity distribution, and alpha particle induced plasma instabilities can be accomplished with both spatial and temporal resolution. Advantages include long pulse operation which can make possible very high signal to noise ratios and use of millimeter waves which maximizes the Doppler shifted scattered signal in WHz^{-1} and makes possible scattering angles up to 180°. Extraordinary mode scattering at approximately 60 and 200 GHz would be used in TFTR and CIT respectively, and 140 GHz ordinary mode scattering in JET. 8 refs., 1 fig.

13624 (DOE/ET/51013—233) Gyrotron scattering from non-thermal fluctuations in the Tara Tandem Mirror. Machuzak, J.S.; Myer, R.C.; Woskoboinikow, P.P.; Cohn, D.R.; Gerver, M.; Golovato, S.N.; Horne, S.; Kubota, S.; Mulligan, W.J.; Post, R.S. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Sep 1987. Contract AC02-78ET51013. 7p. (PFC/CP—87-14; CONF-871210—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002594/JAW.

From 12. annual international conference of the Institute of Electrical and Electronics Engineers on infrared and millimeter waves; Orlando, FL, USA (14 Dec 1987).

A 137 GHz, ~0.4 kW, 75 ms pulsed gyrotron has been used for collective Thomson scattering in the Tara Tandem Mirror plug cell at MIT. Scattering from ion cyclotron waves during ion cyclotron resonance frequency (ICRF) heating, ion Bernstein wave har-

monics, and plasma fluctuations possibly due to microinstabilities have been observed. The observed harmonic nature of the ion Bernstein waves may be due to an enhanced ion thermal frequency spectrum in an ICRF heated plasma. 6 refs., 1 fig.

13625 (ENEA-RT-FUS—85-12) 8 MW lower hybrid electron mode system for the additional heating of the plasma of the FTU Tokamak. Andreani, R.; De Marco, F.; Ferro, C.; Mirizzi, F.; Papitto, P.; Santini, F.; Segre, S.E.; Sassi, M. (ENEA, Frascati, Italy. Dipt. Fusione). (ENEA, Rome (Italy)). 1985. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701268/JAW.

The "Electron Mode" regime of LH Heating, based on the same physics as the current drive, has been extensively studied and experimentally tested especially with respect to the relation between frequency and density limit. These results have largely contributed to the decision to build a CD system on TORE SUPRA. Based on the same motivations, the Lower Hybrid 'Electron Mode' Heating (frequency: 8 "Electron Mode" Heating (frequency: 8 GHz), has been chosen to heat the plasma of the FTU Tokamak. The RF power required (8 MW at 8 GHz) will be produced by 16 gyrotron oscillators (500 KW unit power) feeding 16 grill couplers installed on 8 equatorial ports of FTU. The dc power supplies will be ,odularly built to be compatible even with completely different sort of tubes (e.g. for IRCH). The transmission lines between the generators and the grills will be circular oversized waveguides to reduce the losses to less than 1 dB. Each grill will consist of an 8x8 matrix of rectangular waveguides pressurized and terminated by thik (one wavelength) alumina windows facing the grill mouth. Gyrotron availability has been verified through studies conducted by the two major manufacturers presently on the market. Preliminary quotations and delivery times have been obtained. The design of the grill couplers has been supplemented by a study contract with an industrial research laboratory which is producing a prototype structure and ceramic windows with very promising results. Microwave mode converters and power dividers for the transmission system have been designed and prototypes are being built and will be tested shortly. An 8 GHz, 25 KW cw test bench has been already commissioned and will be used to test all the microwave components. The power level is more than adequate also to process single channels of the coupling structures. 23 refs.

13626 (ENEA-RT-FUS—85-18) Density limit in Tokamaks. Alladio, F. (ENEA, Frascati, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700987/JAW.

A short summary of the present status of experimental observations, theoretical ideas and understanding of the density limit in tokamaks is presented. It is the result of the discussion that was held on this topic at the 4th European Tokamak Workshop in Copenhagen (December 4th to 6th, 1985). 610 refs.

13627 (ENEA-RT-FUS—86-13) Calculation of Tritium burnup in Tokamaks. Bittoni, E.; Haegi, M. (ENEA, Bologna, Italy. Centro Ricerche Energia; ENEA, Frascati, Italy. Centro Ricerche Energia). (ENEA, Rome (Italy)). 1987. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700988/JAW.

In a deuterium plasma tokamak, the contained fusion-produced tritons are supposed to be decelerated down to thermalization according to classical Coulomb scattering. A fraction of these fast tritons undergoes the DT fusion reaction producing 14.1 MeV neutrons. It is thus possible to get information on the confinement of these fast tritons by comparing the measured and the calculated ratio of the 14.1 MeV to the 2.45 MeV neutron flux. This report describes the calculation of this flux ratio by means of a numerical Monte Carlo-like code.

13628 (EUR-CEA-FC—1330) Comparison between voltage by turn measured on different tokamaks operating in hybrid wave current drive regime. Briffod, G.; Hoang, G.T. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jun 1987. 24p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88751851/JAW.

On a tokamak in a current drive operation with a hybrid wave, the R.F. current is estimated from the voltage drop by plasma turn generated by R.F. power application. This estimated current is not proportional to the injected power. There still exists in the plasma an electric field corresponding to the current part produced by induction. The role evaluation of this parameter on the current drive efficiency is important. In this report the relation voltage-R.F. current is studied on Petula and results on the voltage evolution by turn on different machines are compared.

13629 (EUR-CEA-FC—1331) Study of the fast neutral atom beam injection on TFR tokamak. Roubin, J.P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jul 1987. 273p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number TI88751852/JAW.

During neutral beam injection experiments on TFR, the increase of the plasma temperature appears to be weak and is saturating at high power. This observation leads to question the classical scheme of power coupling to the thermal plasma and to check experimentally its successive steps. First of all, the neutral beam transmission and capture in the plasma, measured by calorimetric methods, are in agreement with the classical calculations. Next the confinement and thermalization of the fast ions is reviewed by means of three different measurements: charge exchange analysis of fast neutrals leaving the plasma (an auxiliary modulated neutral beam gives a spatially resolved measurement); neutron flux analysis during injection of deuterium ions into a deuterium plasma; measurement of the fast ions trapped in the toroidal magnetic field ripples. These experiments show that a non-classical mechanism transports the most energetic ions towards the plasma periphery. This phenomenon then limits the overall power that can be effectively absorbed in the plasma centre and contributes to deteriorate the energy confinement. Finally the respective role of thermal and non-thermal populations in the power balance is addressed.

13630 (IA—1424) New methods of confinement and heating of plasma in magnetic fields. Kishinevsky, M. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). May 1987. 86p. (In Hebrew). NTIS (US Sales Only), PC A05/MF A01. Order Number TI88701021/JAW.

Contains an annotated bibliography of 55 references.

In this work two new schemes of plasma magnetic trapping are proposed: Tandem Mirror and Torodially Linked Mirrors. Calculation and analysis of plasma confinement were performed and a problem of stochastical diffusion losses were experimentally studied. This has shown that Tandem Mirror Trap does not have a classical energy gain limitation of the usual magnetic mirror and can eventually reach an ignition ($Q = \infty$). In the Toroidally Linked Mirrors the radial losses can be substantially reduced by using ICRF power and by localizing of the curvature region in high-magnetic field sections. Concerning the heating, an experimental and theoretical research was performed on negative hydrogen ion production mechanism for charge exchange plasma fueling and heating. Mechanism of secondary ion emission from metal surfaces was explained and experiment on hydrogen dynamics on the cathode surface have been carried out.

13631 (INIS-mf—11073) Electron cyclotron emission spectroscopy on thermonuclear plasmas. Instrumental aspects, calibration and applications. Tubbing, B.J.D. (Rijksuniversiteit Utrecht (Netherlands)). 20 May 1987. 346p. NTIS (US Sales Only), PC A15/MF A01. Order Number DE88700817/JAW.

Includes summary in Dutch and previously published material.

Analysis of electron cyclotron emission (ECE) enables one to infer the radial profile of the electron temperature in tokamaks. The Dutch FOM institute for plasma physics has designed, built, installed and operated a grating polychromator for ECE measurements at JET. This thesis deals with a few instrumental aspects of this project and with applications of ECE measurements in tokamak physics studies. Ch. 3 and 4 deal with the wave transport in ECE systems. In Ch. 3 a method is developed to infer the mode

conversion, which is a source for transmission losses, in a waveguide component from the antenna pattern of its exit aperture. In Ch. 4 the design and manufacture of the waveguide transition system to the grating polychromator are described. In Ch. 5 a method is reported for calibration of the spectrometers, based on the use of a microwave source which simulates a large area blackbody of very high temperature. The feasibility of the method is tested by applying it to two different ECE systems. In Ch. 6 a study of heat pulse propagation in tokamak plasma's, based on measurement of the electron temperature with the grating polychromator, is presented. 105 refs.; 48 figs.; 8 tabs.

13632 **(INIS-mf—11089) 16th AINSE plasma physics conference. Conference handbook.** (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). 1987. 107p. (CONF-870207—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW.

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

Abstracts of papers, the conference program and general information is included in the conference handbook.

13633 (INIS-mf—11089, pp 11) **Recent results in rotamak research.** Donnelly, I.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13634 (INIS-mf—11089, pp 12) **Rotamak research at Flinders University.** Kirolous, H.A.; Brotherton-Ratcliffe, D.; Jones, I.R. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13635 (INIS-mf—11089, pp 13) **Influence of a toroidal magnetic field on a rotamak discharge.** Collins, G.A.; Durance, G.; Hogg, G.R.; Tendys, J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13636 (INIS-mf—11089, pp 14) **Effect of a toroidal magnetic field on the RMF current drive mechanism.** Bertram, W.K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13637 (INIS-mf—11089, pp 15) **MHD equilibrium in the rotamak.** Watterson, P.A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13638 (INIS-mf—11089, pp 16) **Plasma focus - an approach to plasma fusion studies for developing countries.** Lee, S. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13639 (INIS-mf—11089, pp 17) **Current directions in laser-plasma interaction physics.** Luther-Davies, B. (Australian National Univ., Canberra. Dept. of Engineering Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13640 (INIS-mf—11089, pp 18) **Absorption in high-intensity laser-plasma interactions.** Perry, A.; Dragila, R.; Luther-Davies, B. (Australian National Univ., Canberra. Dept. of Engineering Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13641 (INIS-mf—11089, pp 19) **Frequency modulation of laser radiation reflected from an expanding laser produced plasma.** Maddever, A.; Luther-Davies, B.; Dragila, R. (Australian National Univ., Canberra. Dept. of Engineering Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13642 (INIS-mf—11089, pp 20) **Basic change in laser fusion.** Hora, H. (New South Wales Univ., Kensington, Australia. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13643 (INIS-mf—11089, pp 21) **Alfven waves in tokamaks - their excitation and effect on plasma properties.** Collins, G.A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13644 (INIS-mf—11089, pp 22) **Effect of the direction of antenna current elements on alfven wave excitation.** Ballico, M. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13645 (INIS-mf—11089, pp 23) **Far infrared laser scattering from plasma waves.** Bowden, M.D.; James, B.W.; Stimson, P.A. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13646 (INIS-mf—11089, pp 26) **Corona and glow discharges in SF/sub 6/.** Woolsey, G.A. (New England Univ., Armidale, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13647 (INIS-mf—11089, pp 32) **High beta stability studies of free-boundary helical equilibria.** Gardner, H.J.; Dewar, R.L. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13648 (INIS-mf—11089, pp 35) **Gyrotron applications to plasma physics.** Brand, G.F. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13649 (INIS-mf—11089, pp 40) **Review of <j x b> current drive in conventional toroidal plasma vessels.** McCarthy, A.L. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13650 (INIS-mf—11089, pp 41) **Recent results for <j x b> current drive in the RF tokamak RYTHMAC.** Dutch, M.J.; McCarthy, A.L. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13651 (INIS-mf—11089, pp 44) **CSIRO - University of Sydney far infrared laser.** Falconer, I.S.; James, B.W.; Stimson, P.A.; MacFarlane, J.C.; Whitbourn, L.B. (Sydney Univ., Australia. Dept. of Plasma Physics; Commonwealth Scientific and Industrial Research Organization, Lindfield, Australia. Div. of Applied Physics; Commonwealth Scientific and Industrial Research Organization, North Ryde, Australia. Div. of Mineral Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13652 (INIS-mf—11089, pp 46) **Alfven wave excitation in the TORTUS tokamak.** Lehane, J.A.; Cross, R.C.; Brennan, M.H.; Murphy, A.B. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13653 (INIS-mf—11089, pp 51) **Studies of magnetically confined arcs and pulsed arcs.** Swift, P.D. (Sydney Univ., Australia. School of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13654 (INIS-mf—11089, pp 52) **Continuous plasma centrifuge.** Seebacher, P.; Simpson, S.W.; Messerle, H.K. (Sydney Univ., Australia. School of Electrical Engineering). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13655 (INIS-mf—11089, pp 53) **Ionisation and heating in the AAEC rotamak.** Collins, G.A.; Hogg, G.R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13656 (INIS-mf—11089, pp 54) **Energy transfer processes in rotamak plasmas.** Donnelly, I.J.; Rose, E.K.; Cook, J.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13657 (INIS-mf—11089, pp 60) **Calculation of Z and Z/sup 2/ numbers in heavy atom-plasmas by means of statistical Thomas-fermi model versions.** Szichman, H.; Eliezer, S.; Salzmann, D. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13658 (INIS-mf—11089, pp 63) **Investigation of a magnetron sputtering discharge.** Turner, G.M. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13659 (INIS-mf—11089, pp 69) **Generation of X-rays and neutrons by a plasma excited with a RF discharge.** Schneider, R.T.; Handel, P.H. (Florida Univ., Gainesville, USA; Missouri Univ., St. Louis, USA). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13660 (INIS-mf—11089, pp 70) **Imaging techniques for RF plasma investigations.** Kemp, W.J. (New England Univ., Armidale, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13661 (INIS-mf—11089, pp 74) **Alfven wave heating of current-carrying plasmas.** Clancy, B.E.; Donnelly, I.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13662 (INIS-mf—11089, pp 76) **Generation of axial magnetic fields in a laser-produced plasma by a turbulent dynamo.** Dragila, R. (Australian National Univ., Canberra. Dept. of Engineering Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13663 (INIS-mf—11089, pp 77) **Particle simulation of heat transfer between two plates in a low pressure gas.** Blackwell, B.D.; Boswell, R.W. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13664 (INIS-mf—11089, pp 80) **Heating and confinement in the Asperator.** Takeuchi, N. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13665 (INIS-mf—11089, pp 81) **Boson-antiboson plasma and vacuum in an intense magnetic field.** Witte, N.S.; Hines, K.C.; Kowalenko, V. (Melbourne Univ., Parkville, Australia. School of Physics; Materials Research Labs., Maribyrnong, Australia). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13666 (INIS-mf—11089, pp 83) **Generation and maintenance of a field reversed configuration by means of a rotating magnetic field.** Knight, A.; Jones, I.R.; Wu Cheng. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13667 (INIS-mf—11089, pp 91) **Generalised coordinates for imperfect magnetic surfaces.** Dewar, R.L. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13668 (INIS-mf—11089, pp 92) **Phase-amplitude imaging : its application to fully automated analysis of magnetic field measurements in laser-produced plasmas.** Kalal, M.; Luther-Davies, B.; Nugent, K.A. (Australian National Univ., Canberra. Dept. of Engineering Physics; Melbourne Univ., Parkville, Australia. School of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

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13669 (INIS-mf—11089, pp 93) **Heliacs - the world scene.** Hamberger, S.M. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13670 (INIS-mf—11089, pp 94) **Plasma fluctuations in the toroidal heliac SHEILA.** Shi, X.H.; Blackwell, B.D.; Hamberger, S.M.; Sharp, L.E. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13671 (INIS-mf—11089, pp 95) **Studies of high frequency microstructures in LT4 by the scintillation method.** Sharp, L.E.; Nazikian, R.; Hamberger, S.M. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13672 (INIS-mf—11089, pp 36) **Recent developments in far infrared plasma diagnostics.** Falconer, I.S. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13673 (INIS-mf—11089, pp 37) **Recent results from an experiment to measure ion temperature in TCA tokamak by collective Thomson scattering of far infrared radiation.** Krug, P.A.; Behn, R.; Kjelberg, I.; Salito, S.A.; Siegrist, M.R. (Centre de Recherches en Physique des Plasmas, Lausanne, Switzerland). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

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13674 (INIS-mf—11089, pp 38) **Spatially scanning far infrared interferometer.** Stimson, P.A. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13675 (INIS-mf—11089, pp 39) **Laser-induced fluorescence on TORTUS tokamak.** Wright, W. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13676 (INIS-mf—11089, pp 47) **TORTUS neutral particle analyser.** Moore, K.J. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13677 (INIS-mf—11089, pp 48) **Neutral hydrogen temperature measurement from H/sub α/ emission.** Tinney, C.G.; James, B.W. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

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13678 (INIS-mf—11089, pp 55) **Electric probe measurements in a rotamak.** Tendys, J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13679 (INIS-mf—11089, pp 43) **Effect of RF-induced magnetization on the perpendicular ponderomotive force.** Sawley, M.L.; Vaclavik, J. (Centre de Recherches en Physique des Plasmas, Lausanne, Switzerland). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13680 (INIS-mf—11089, pp 68) **Electromagnetic acceleration of plasma to 4 megameters per second.** Marshall, R.A. (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13681 (INIS-mf—11089, pp 24) **LT-4 runaway electron energies.** Cheetham, A.D.; Kuwahara, H.; Morton, A.H. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13682 (INIS-mf—11089, pp 25) **Comparison between interferometrically measure structures of low order MHD modes in LT4 and theoretical predictions.** Nazikian, R.; Sharp, L.E.; Hamberger, S.M. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13683 (INIS-mf—11089, pp 27) **Trace impurity effects on a weakly ionized N/sub 2/ plasma.** Ernest, A.; Sato, N.; Haydon, S.C. (New England Univ., Armidale, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13684 (INIS-mf—11089, pp 28) **Laser-induced opto-galvanic effects in gaseous plasmas.** Yumin, Wang; Ernest, A.; Haydon, S.C. (New England Univ., Armidale, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13685 (INIS-mf—11089, pp 30) **Source on the initiating electron in the breakdown of SF/sub 6/.** Ogle, D.B.; Woolsey, G.A. (New England Univ., Armidale, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13686 (INIS-mf—11089, pp 33) **Bifurcation and coalescence of non-linear tearing modes.** Parker, R.D.; Dewar, R.L. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13687 (INIS-mf—11089, pp 42) **Dynamical stabilisation of resistive ideal instabilities in the ROTAMAK.** Brotherton-Ratcliffe, D. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13688 (INIS-mf—11089, pp 45) **Experimental observations of tearing modes in TORTUS.** Giannone, L.; Cross, R.C.; Hutchinson, I.H. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13689 (INIS-mf—11089, pp 65) **Laboratory and computer experiments on the beam-plasma discharge.** Morey, I.J.; Boswell, R.W. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13690 (INIS-mf—11089, pp 86) **Resistive magnetohydrodynamics.** Storer, R.G. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13691 (INIS-mf—11089, pp 34) **Oscillation-centre theory at resonance.** Kentwell, G.W. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13692 (INIS-mf—11089, pp 50) **Thermal effects on parallel propagating ion cyclotron waves.** Ball, L.T. (Sydney Univ., Australia. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13693 (INIS-mf—11089, pp 56) **Surface wave induced high transparency of an overdense warm plasma layer.** Vukovic, S.; Dragila, R. (Australian National Univ., Canberra. Dept. of Engineering Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13694 (INIS-mf—11089, pp 59) **Feedback in a new resonance of laser-plasma interaction.** Goldsworthy, M.P.; Hora, H.; Stening, R.J. (New South Wales Univ., Kensington, Australia. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13695 (INIS-mf—11089, pp 61) **Vacuum modes of a helical waveguide with a central core.** Cooper, G.; Blackwell, B. (Australian National Univ., Canberra. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13696 (INIS-mf—11089, pp 71) **Localised propagation of the Alfven wave in toroidal hydrogen and hydrogen-deuterium plasmas.** Borg, G.G.; Brennan, M.H.; Cross, R.C.; Lehane, J.A. (Sydney Univ., Australia. Dept. of Plasma Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13697 (INIS-mf—11089, pp 72) **Surface waves on magnetized plasmas.** Cramer, N.F. (Sydney Univ., Australia. School of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13698 (INIS-mf—11089, pp 78) **Propagation of Bernstein waves in the SHEILA heliac.** Blackwell, B.D. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13699 (INIS-mf—11089, pp 79) **Spatial and temporal evolution of an argon magnetoplasma.** Prytz, A.; Boswell, R.W. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13700 (IPPJ-DT—134) **Emissions from heavy current carrying high density plasma and their diagnostics.** Hirano, Katsumi (ed.). (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jun 1987. 114p. (In Japanese). (CONF-8612117—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88751436/JAW.

From Workshop on emissions from heavy current carrying high density plasma and diagnostics; Nagoya, Japan (3 Dec 1986).

Workshop on "Emissions from heavy current carrying high density plasma and diagnostics" was held at Institute of Plasma Physics, Nagoya University on 3. and 4. December 1986 under a collaborating research Program. The workshop was attended by 43 researchers from 19 laboratories. A total of 22 papers were submitted and are presented in these proceedings. The largest group of papers was that on soft X-ray emission. It seems this topic is a foremost interest for groups which engaged in research of the Z pinch and the plasma focus. A variety of problems in pinched dense plasmas, namely spectroscopy, diagnostics, pinch dynamics, and related engineering aspects were also discussed.

13701 (IPPT-IFTR—11/1984) **Field near a signal front in the waveguide filled with dispersive plasma.** Brahmer-Kacprzynska, A. (Polska Akademia Nauk, Warsaw. Inst. Podstawowych Problemow Techniki). 1984. 12p. (In Polish). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701363/JAW.

Green function for plane waveguide with perfectly conducting walls filled with homogeneus electron plasma is presented. The field near a signal front for the case of inhomogeneus plasma is presented as an appropriate sum of Bessel functions. (L.I.).

13702 (JAERI-M—87-116) **Preliminary analysis on plasma equilibrium control. Conceptual design study of FY86 FER.** Abe, Mitsushi; Takeuchi, Kazuhiro; Ueda, Noriaki. (Japan Atomic Energy Research Inst., Tokyo). Aug 1987. 16p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751441/JAW.

Survey of the plasma experiments about dependence of plasma confinement on plasma shaping, prescription of the space state equation for plasma shape control using MHD equilibrium equation and analysis of steady state deformation of plasma cross sectional shape due to plasma parameter disturbances were caried out for the shake of preliminary study of plasma equilibrium control in the Fusion Experimental Reactor (FER). Experiments so far showed that it is desirable to control plasma surface position within 1 cm error, but the analysis here showed that possible disturbance may shift it by 2 - 3 cm and it is difficult to control plasma whole surface in good accuracy only with the plasma position control coils which is placed at the inner area of the toroidal coils.

13703 (JINR-R—17-87-128) **Plasma wave radiative damping of a new type in a relativistic one-dimensional plasma.** Bogolyubov, N.N.; Polyakov, P.A.; Tasev, M.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701191/JAW.

Submitted to the journal Teor. Mat. Fiz. .

The disperion equation for plasma waves in a relativistic one-dimensional plasma is investigated taking into account radiative damping of charged particles. This kind of plasma oscillations is shown to undergo an additional attenuation in ultra-relativistic case due to radiative braking of charged particles in the collective field of the wave. This extra damping is proved to be less than one at nonrelativistic temperatures. 15 refs.

13704 (KFTI—87-18) **Kinetics of electrons and molecules at plasma-beam discharge in molecular gases.** Karas', V.I.; Mukhin, V.V.; Naboka, A.M.; Novikov, V.E. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701196/JAW.

Effect of molecule distribution by oscillating levels on plasma-beam discharge characteristics in molecular gases has been considered. It is shown that under conditions of gas low temperature T << T/sub v/ and TE/sub 1//ΔE<< ϵ/sub 0/ the higher rate of a chemical reaction can be obtained under conditions of strong nonequilibricity, i.e. when the larger stage of oscillating molecule energy is in states with strong anharmonicity. Expressions for the length of beam relaxation shaping a plasma-beam charge have been obtained taking into account self-consistently nonequilibricity of molecule distribution by oscillating levels and chemical reaction running. It is shown that the length of beam relaxation increases with the growth of the degree of nonequilibricity distribution by oscillating levels. 23 refs.

13705 (KFTI—87-22) **Plasma diagnostics in the Uragan-3 torsatron by using external magnetic measurements.** Gutarev, Yu.V.; Kuznetsov, Yu.K.; Pashnev, V.K.; Ponomarenko, N.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701197/JAW.

Methods for determination of equilibrium plasma configuration parameters in a stellarator using external magnetic measurements are considered. Measurements of a diamagnetic signal, total current in the plasma and the averaged in a big azimuth fluxes of the poloidal field of plasma currents are carried out. The theoretical model of plasma equilibrium in the stellarator based on a set of averaged MHD equations is used to analyze measurement results. These methods are used in the "Uragan-3" torsatron experiment. 15 refs.; 3 figs.

13706 (KIYI—86-17) **Parametric instabilities of inhomogeneous plasma near the lower-hybrid resonance.** Davydova, T.A.; Marchenko, V.S. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. 46p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number TI88701201/JAW.

Parametric instabilities of inhomogeneous plasma near the lower-hybrid resonance taking account of linear transformation of the pump wave are analytically investigated. Corresponding threshold conditions, temporal growth rates, the structure and domain of localization of unstable modes are obtained. It is shown that at the linear stage of instability compression of localization domain of unstable modes takes place. This should result in fast dissipation of HF energy in the resonance region. By optimal choice of lower-hybrid wave power and other parameters these processes will result in the heating of a central region of plasma filament in tokamaks. 30 res.; 1 figs.

13707 (ORNL/TM—10612) **Influence of fast alpha diffusion and thermal alpha buildup on tokamak reactor performance.** Uckan, N.A.; Tolliver, J.S.; Houlberg, W.A.; Attenberger, S.E. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 37p. (CONF-8706119—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003661/JAW.

From Workshop on alpha particle effects in ETR; Washington, DC, USA (15 Jun 1987).

The effect of fast alpha diffusion and thermal alpha accumulation on the confinement capability of a candidate Engineering Test Reactor (ETR) plasma [Tokamak Ignition/Burn Experimental Reactor (TIBER-II)] in achieving ignition and steady-state driven operation has been assessed using both global and 1-1/2-D transport models. Estimates are made of the threshold for radial diffusion of

fast alphas and thermal alpha buildup. It is shown that a relatively low level of radial transport, when combined with large gradients in the fast alpha density, leads to a significant radial flow with a deleterious effect on plasma performance. Similarly, modest levels of thermal alpha concentration significantly influence the ignition and steady-state burn capability. 23 refs., 9 figs., 4 tabs.

13708 **(PB—88-119656/XAB) Bulletin of the Electrotechnical Laboratory, Vol. 50, Nos. 5 and 6, 1986. Special issue: Plasma Physics and Controlled Fusion Research.** (Electrotechnical Lab., Sakura, Ibaraki (Japan)). 1986. 336p. (In Japanese). NTIS, PC E12/MF A01.

Text in Japanese with English abstracts and six articles in English.

Partial contents include: 80-kV capacitor for high-current pulse; High-voltage coaxial cable in pulsed power system; Bata and energy confinement of TPE-2 plasma; MHD behavior and fluctuations in TPE-2; Generation and removal of light impurities in TPE-2 plasma; Simulation of a toroidal pinch with an elliptic cross section (in English); Stability of toroidal plasma with non-circular cross section; Radiation-loss measurement of reversed-field-pinch plasma (in English); Volt-second consumption during the start-up phase of TPE-IR (M) (in English); Experimental study of toroidal Z-pinch; Derivation of a reduced set of equations for a resistive tearing mode (in English); and Renormalized nonlinear dielectric function for a drift wave (in English).

13709 **(PB—88-119664/XAB) Bulletin of the Electrotechnical Laboratory, Vol. 50, No. 12, 1986.** (Electrotechnical Lab., Sakura, Ibaraki (Japan)). 1986. 100p. (In Japanese). NTIS, PC E06/MF A01.

Text in Japanese with English abstracts and one article in English.

Table of contents include: 7-Ethoxycoumarins as new fluorescent probes of microenvironment for micellar solutions of sodium dodecyl sulfate (in English); Equilibria of toroidal Z pinch; Review of cryogenic refrigerator and heat pump for space use; Review on space solar-dynamic power system and thermal energy storage; Review of the sodium thermoelectric converter for aerospace power; The construction of a private data base by using FAIRS-I.

13710 **(UCRL—15979) Plasma confinement calculations for TIBER-II: Final report.** Ibrahim, E. (California Univ., Berkeley (USA)). 14 Oct 1987. Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004044/JAW.

This paper compares the empirically based TIBER II design parameters against the reactor parameters of a tokamak based on a theoretical model of heat transport. The motivation behind this project is the following. The present TIBER-II design is based on an empirical scaling of confinement time tau/sub E/ known as Kaye-Goldston scaling. This empirical scaling is based on data from tokamak plasmas whose temperatures did not exceed a few keV, while the TIBER-II requires electron temperatures of 25 keV. The question, then, is whether the Kaye Goldston scaling is valid at temperatures above the range of empirical data. For this we must turn to theory. If a theoretical transport model is available that shows favorable correlation with the Kaye-Goldston scaling in the range of a few keV, then this scaling could be extrapolated to the 25 keV range required for TIBER-II. The project is divided into two parts. Part one of the project concerns the development of a transport model from plasma theory that has empirical support. Part two of the project consists of applying the transport model to the TIBER-II design. 8 refs., 3 tabs.

13711 **(UCRL—53834) Plasma potential measurements in the Tandem Mirror Experiment-Upgrade using a time-of-flight neutral particle analyzer.** Carter, M.R. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 235p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88003975/JAW.

We have developed a technique to measure the magnitude of electrostatic potentials using neutral particle analysis. We have constructed a time-of-flight neutral particle analyzer to measure the velocity distribution of the neutral particles emitted from the midplane of the East end cell of TMX-U. The analyzer is collimated to accept particles with a 22.5° pitch angle, within the magnetic loss cone of the end cell. This location and orientation allows study of the potentially confined ions in the end cell. In particular, ions with sufficient energy to escape over the confining potential are lost in a single pass. The density of these ions can be substantially lower than the density of ions confined by the potential. The boundary between the confined and unconfined ions appears as a break in the measured distribution. From the energy of the break, one can determine the magnitude of the potential confining the ions. The depth of the thermal barrier and the existence and magnitude of a potential peak between the thermal barrier and the central cell can also be inferred from similar breaks in the distribution function. Information on the magnitude and time dependence of these potentials is important in understanding the formation of potentials in tandem mirrors and the role potentials play in plasma confinement. The potential measurements from the Time-of-Flight analyzer are found to be consistent with a thermal-barrier type axial potential profile. During plugging conditions, the ion confining potential is at least a few hundred volts, sufficiently large to reduce the ion end losses to immeasurable levels. During the loss-of-plugging, the ion confining potential and thermal-barrier depth both decrease. The measured axial confinement time is found to agree with the theoretical predictions for potential confinement. 63 refs., 110 figs., 4 tabs.

13712 **Extension of "Four-dimensional eikonal theory of linear mode conversion" to parametrically unstable media.** Williams, E.A. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review Letters;* **59**: No. 23, 2709-2709(7 Dec 1987). Contract W-7405-ENG-48.

A Comment on the Letter by Lazar Friedland, Galya Goldner, and Allan N. Kaufman, Phys. Rev. Lett. 58, 1392 (1987).

13713 **Measurements of excitation rate coefficients for Al-like ions: Fe XIV, Ni XVI, and Cu XVII.** Datla, R.U.; Roberts, J.R.; Durst, R.D.; Hodge, W.L.; Klepper, C.C.; Rowan, W.L.; Mann, J.B. (Atomic and Plasma Radiation Division, Center for Radiation Research, National Bureau of Standards, Gaithersburg, Maryland 20899). *Physical Review [Section] A: General Physics;* **36**: No. 11, 5448-5450(1 Dec 1987).

Absolute excitation rate coefficients for Fe XVI and Ni xvi ions ions are measured spectroscopically in the Texas Experimental Tokamak. Previous measurements for the 3d-3p transition array of Cu XVII are verified and the measurements are extended to the $3s3p^2 \rightarrow 3s^23p$ transition array of this ion. The experimental rate coefficient for the 3d-3p transition array of Fe XIV is 6.2 x 10^{-9} cm^3 s^{-1} at an electron temperature near 160 eV and for Ni XVI and Cu XVII, the values are 4.2 x 10/sup -9/ and 3.8 x 10/sup -9/ cm^3 s/ sup -1/, respectively, at an electron temperature near 240 eV. For the $3s3p^2$ ^2P/sub 3/2/$\rightarrow 3s^23p$ ^2P/sub 3/2/ transition array, the experimental excitation rate coefficient for Fe XIV is 8.2 x 10^{-9} cm^3 s^{-1} at an electron temperature near 160eV and for Ni XVI and Cu XVII the value is 5.5 x 10^{-9} cm^3 s^{-1} at an electron temperature near 240 eV. The uncertainty in these results is estimated to be +- 50% (one standard deviation). Computed values of absolute excitation rates in a distorted-wave approximation and Mewe's semiempirical formula are found to be in good agreement with the experimental values.

13714 **Fluid theory of ion collection by probes in strong magnetic fields with plasma flow.** Hutchinson, I.H. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **30**: No. 12, 3777-3781(Dec 1987).

A one-dimensional fluid theory of Langmuir probe operation in strong magnetic fields is presented. Cross-field diffusion of ions both into and out of the the collection region is consistently accounted for, in effect taking momentum and particle diffusivity to be equal. The results differ by significant factors from previous analyses, which did not account for outward diffusion but in effect set momentum diffusivity to zero. The differences are especially large when parallel flow of the external plasma is present. It is thus clear that the value assumed for the momentum diffusivity strongly

affects the interpretation of recent probe measurements. It is argued that the present results offer a more reliable basis for this interpretation.

13715 **Refueling pellets as a source of charge exchange neutrals for alpha particle measurements.** Gerdin, G. (Nuclear Engineering Department, Fusion Studies Laboratory, 103 S. Goodwin, Urbana, Illinois 61801). *Physics of Fluids;* 30: No. 12, 3782-3800(Dec 1987).

Alpha interactions with neutrals in the ablation cloud of a refueling pellet are considered as a fast alpha diagnostic through charge-capture radiation (ACCR) by the alphas or their complete neutralization and escape. Calculations of pellet penetration into a reactor plasma indicate that regions of r/a>0.61 could be reached by refueling pellets with initial radii of 4 mm, hence this would be an outer core diagnostic. A spherically symmetric neutral-gas shielding model (SSMNGSM) in which ionization is treated self-consistently and governed by local thermodynamic equilibrium is used in these calculations. Collisional processes are found to govern the alpha—cloud interactions and local equilibrium calculations were performed in which the charge exchange and ionization cross sections are used to obtain the state fractions of the alphas in the cloud. At 1640 A the ratio of ACCR to cloud bremsstrahlung is found to be 10^{-5} whereas at 304 A this ratio ranges from 3×10^{-3} to 0.5 for the cases considered; no neutralized alphas escape the cloud. Magnetic field effects are considered and they appear to reduce the bremsstrahlung from the cloud by a factor of 300 at 304 A in regions perpendicular to the magnetic field from the pellet's surface; escape of neutralized alphas may be possible in these directions. Alpha refueling pellet interactions are potentially useful as outer core fast alpha diagnostics and this could be tested in near term experiments.

13716 **Diagnosis of mildly relativistic electron velocity distributions by electron cyclotron emission in the Alcator C tokamak.** Kato, K.; Hutchinson, I.H. (Plasma Fusion Center and Department of Nuclear Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* 30: No. 12, 3809-3820(Dec 1987).

Electron cyclotron emission from nonthermal electron distributions has been measured with a vertical view and control of multiple reflections. The observed intensities at the first few harmonics provide information that can be used to deduce the electron distribution function. Although harmonic overlap restricts the detail that can be obtained when the distribution is very energetic, a fitting procedure enables useful results to be obtained. The distribution functions during Ohmic runaway and lower-hybrid current drive and heating are presented. The current-drive distributions are not inconsistent with theoretical Fokker—Planck calculations, giving perpendicular and parallel "temperatures" around 60 keV and 200 keV, respectively. The runaway cases have quite similar distributions.

13717 **Experimental studies of the dynamics of a linear high-beta stellarator.** Hedin, E.R.; Koepke, M.E.; Ribe, F.L. (University of Washington, Seattle, Washington 98195). *Physics of Fluids;* 30: No. 12, 3821-3824(Dec 1987).

In a linear l = 1 stellarator [Phys. Fluids 30, 2885 (1987)] internal probes are used to measure the structure and temporal behavior of the plasma and magnetic field. At lower densities (and higher temperatures) diffuse-profile equilibria are produced that are perturbed by a k≅0 oscillation. At higher densities (and lower temperatures) sharp-boundary plasmas are produced that are unstable with an exponentially growing m = 1, k≅0 mode. Finite Larmor radius (FLR) effects are adduced to explain the absence of the instability in the oscillatory regime.

13718 **Theory of nonmonotonic double layers.** Kim, K.Y. (Electronics Research Laboratory, University of California, Berkeley, California 94720). *Physics of Fluids;* 30: No. 12, 3686-3694(Dec 1987).

A simple graphic method of solving the Vlasov—Poisson system associated with nonlinear eigenvalue conditions for arbitrary potential structures is presented. A general analytic formulation for nonmonotonic double layers is presented and illustrated with some particular closed form solutions. This class of double layers satisfies the time stationary Vlasov—Poisson system while requiring a Sagdeev potential, which is a double-valued function of the physical potential. It follows that any distribution function having a density representation as any integer or noninteger power series of potential can never satisfy the nonmonotonic double-layer boundary conditions. A Korteweg—de Vries-like equation is found showing a relationship among the speed of the nonmonotonic double layer, its scale length, and its degree of asymmetry.

13719 **Theory of trapped-particle-induced resistive fluid turbulence.** Biglari, H.; Diamond, P.H. (Institute for Fusion Studies, University of Texas, Austin, Texas 78712-1080). *Physics of Fluids;* 30: No. 12, 3735-3744(Dec 1987).

A theory of anomalous electron heat transport, evolving from trapped-particle-induced resistive interchange modes, is proposed. The latter are a new branch of the resistive interchange-ballooning family of instabilities, destabilized when the pressure carried by the unfavorably drifting trapped particles is sufficiently large to overcome stabilizing contributions coming from favorable average curvature. Expressions for the turbulent heat diffusivity and anomalous electron thermal conductivity at saturation are derived for two regimes of trapped-particle energy: (I) a moderately energetic regime, which is "fluidlike" in the sense that the unstable mode grows faster than the time that it takes for particles in this energy range to precess once around the torus, and (II) a highly energetic regime, where the trapped species has sufficiently high energy as to be able to interact resonantly with the mode. Unlike previous theories of anomalous transport, the estimates of diffusion and transport obtained here are self-consistent since the trapped particles do not "see" the magnetic flutter due to their rapid bounce motion. The theory is valid for moderate electron-temperature, high ion-temperature (auxiliary heated) plasmas and as such, is relevant for present- and future-generation experimental fusion devices.

13720 **Thermally driven convective cells and tokamak edge turbulence.** Thayer, D.R.; Diamond, P.H. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids;* 30: No. 12, 3724-3734(Dec 1987).

A unified theory for the dynamics of thermally driven convective cell turbulence is presented. The cells are excited by the combined effects of radiative cooling and resistivity gradient drive. The model also includes impurity dynamics. Parallel thermal and impurity flows enhanced by turbulent radial diffusion regulate and saturate overlapping cells, even in regimes dominated by thermal instability. Transport coefficients and fluctuation levels characteristic of the saturated turbulence are calculated. It is found that the impurity radiation increases transport coefficients for high density plasmas, while the parallel conduction damping, elevated by radial diffusion, in turn quenches the thermal instability. The enhancement due to radiative cooling provides a resolution to the dilemma of explaining the experimental observation that potential fluctuations exceed density fluctuations in the edge plasma (ePhi/T/sub e/ >n/ n_0).

13721 **Ballooning mode stability of elongated high-beta tokamaks.** Mauel, M.E. (Department of Applied Physics and Nuclear Engineering, Columbia University, New York, New York 10027). *Physics of Fluids;* 30: No. 12, 3843-3844(Dec 1987).

The variational principle derived by Choe and Freidberg [Phys. Fluids 29, 1766 (1986)] and used to estimate the geometry of high-beta tokamak equilibria is extended to include elongation. Ballooning mode stability is then investigated, illustrating the influence of elongation on local and global stability.

13722 **Damping of electron cyclotron waves in dense plasmas of a compact ignition tokamak.** Mazzucato, E.; Fidone, I.; Granata, G. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* 30: No. 12, 3745-3751(Dec 1987).

The absorption of electron cyclotron waves in hot and dense plasmas is investigated by using the relativistic dispersion relation with finite Larmor radius (FLR) corrections. It is shown that the strong reduction caused by FLR effects on the damping of extraor-

dinary waves propagating perpendicularly to the magnetic field becomes insignificant at large values of the parallel component of the refractive index. An application of these results to the auxiliary heating of dense plasmas of a compact ignition tokamak [Plasma Physics and Controlled Nuclear Fusion 1986 (IAEA, Vienna, 1987), Vol. 3] is given. It is shown that the extraordinary mode with oblique propagation and frequency of 190 GHz can be strongly absorbed by dense plasmas with a toroidal magnetic field of 105 kG and a central electron density of 1×10^{15} cm^{-3}.

13723 **Superthermal electron production from hot underdense plasmas.** Aithal, S.; Lavigne, P.; Pepin, H.; Johnston, T.W.; Estabrook, K. (INRS-Energie, C.P. 1020, Varennes, Quebec, JOL 2PO Canada). *Physics of Fluids;* **30**: No. 12, 3825-3831(Dec 1987).

Very-high-energy electrons of up to an energy of ~2.3 MeV have been observed to be emitted from the hot underdense exploding thin foil plasmas created by 10.6 μm CO_2 laser radiation at intensity levels up to ~4×10^{14} W/cm^2. As a supplement to the electron measurements the forward and backward scattered light components were also measured. Correlation of these measurements shows that either Raman scattering or the high-temperature version of two-plasmon decay or both, manifesting themselves near the quarter-critical density region, are responsible for the production of a hot (T/sub h/~135 keV) tail of electrons at least up to energies of 1 MeV. There are no indications that the Raman forward scattering (as distinct from Raman backward scattering) at lower densities plays any significant role. These experimental results are consistent with the results from a 1 1/2 -dimensional particle-in-cell code simulation with a parabolic density profile resembling the experimental conditions. An apparent anomaly is discussed, which is that hot electrons are produced (both in experiments and simulations) at energies higher than the trapping value appropriate to electron plasma waves whose phase velocity is equal to the matching value (C/(3)/sup 1/2/) at the turning point for the light of half the laser frequency.

13724 **Identification of a forbidden line in Kr XXIII.** Benjamin, R.D.; Terry, J.L.; Moos, H.W. (Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, Maryland 21218). *Physical Review [Section] A: General Physics;* **36**: No. 9, 4504-4506(1 Nov 1987).

A line at 1462.65 A in the emission spectrum of Alcator-C plasmas seeded with krypton has been identified as the $3s^23p^2\ ^3P_0$—$3s^23p^2\ ^3P_1$ magnetic dipole transition in Si-like krypton.

13725 **Measurements of the neutron and gamma-ray fluences in the TFTR test cell due to a point source simulating D-T fusion plasma neutron production.** Dickens, J.K.; McConnell, J.W.; Chase, K.M.; Hendel, H.W.; Nieschmidt, E.B.; Tsang, F.Y. (Oak Ridge National Lab., Engineering Physics and Mathematics Div., P.O. Box X, Bldg. 6010, Oak Ridge, TN 37831). *Fusion Technology;* **12**: No. 2, 270-280(Sep 1987). Contract AC02-76CH03073;AC05-84OR21400.

Spectral distributions of high-energy neutrons (0.9 ≦ E/sub n/ ≦ 14.5 MeV) and of high-energy gamma rays (0.4 ≦ E/sub γ/ ≦ 9.4 MeV) due to a deuterium-tritium (D-T) neutron point source simulating the extended fusion plasma neutron source in the Tokamak Fusion Test Reactor (TFTR) at the Princeton Plasma Physics Laboratory are reported. A D-T neutron generator was positioned inside the vacuum vessel at ten different locations around the torus. Neutrons and gamma rays were detected by a liquid-scintillator-based detector (4.65-cm diam X 4.22 cm high) with electronic pulse-shape discrimination to differentiate between events in the detector due to incident neutrons and those due to incident gamma rays. The detector was placed on the median plane of the reactor at 8.85 m from the geometric center of the TFTR. Two spectral distributions, one for neutrons and the other for gamma rays, were obtained for each of 18 measurements. The neutron data exhibit a high-energy peak dominated by uncollided primary-energy neutrons and a low-energy contribution from the scattered neutrons. The gamma-ray data exhibit a high-energy contribution due to neutron capture gamma rays and a low-energy contribution due to gamma rays following neutron inelastic scattering reactions.

13726 **Advanced toroidal facility neutral beam injection. Optimization of beam alignment and aperturing.** Morris, R.N.; Fowler, R.H.; Rome, J.A.; Schlagel, T.J. (Oak Ridge National Lab., Computing and Telecommunications Div., P.O. Box Y, Oak Ridge, TN 37831). *Fusion Technology;* **12**: No. 2, 281-292(Sep 1987). Contract AC05-84OR21400.

The application of the existing Impurity Study Experiment (ISX-B) neutral beam injectors for the Advanced Toroidal Facility is studied. New techniques are required to handle the complicated stellarator geometry of both the vacuum vessel and the plasma. The power delivered to the plasma is found to be a strong function of the beam divergence but only a weak function of the beam focal length. Monte Carlo methods were used to follow the injected particles from the injector until they thermalized in the plasma. An aperture in the beam line is required to prevent excessive heating of the vacuum vessel by the injected beam. Shine-through can be a serious problem if very low density start-ups are necessary. Reasonable assumptions on beam divergence yield an estimate of over 1 MW of power absorbed by the plasma. Preliminary calculations indicate that there are no excessive fast ion losses.

13727 **Model for ionization balance and L-shell spectroscopy of non-LTE plasmas.** Lee, Y.T. (Lawrence Livermore National Lab., CA, USA). *Journal of Quantitative Spectroscopy and Radiative Transfer;* **38**: No. 2, 131-145(Aug 1987). Contract W-7405-ENG-48.

A model has been developed for calculating ionic charge-state distribution and level populations in steady-state non-local thermal equilibrium (non-LTE) plasmas. This model is used to normalize the relative populations for a single ionization stage so that spectral line intensities can be computed as functions of electron temperature and density. These relative populations are determined by the balance of three processes: collisional excitation, de-excitation, and radiative spontaneous emission. As an application of the model, computed spectral-line intensities have been computed for all the $\Delta n = 0$ transitions of nitrogen-, oxygen- and fluorine-like argon ions, and these results have been used to analyze recent experiments.

13728 **What's happening at the edge of tokamaks.** Crandall, D.H. (Department of Energy, Washington, DC, USA. Div. of Applied Plasma Physics). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **27**: No. 4, 475-485(Jul 1987). (CONF-8611124—).

From 3. international workshop on cross sections for fusion and other applications; College Station, TX, USA (6 Nov 1986).

Handling the power deposition at the walls of a plasma fusion device and controlling the particle fueling of the plasma originated the interest in the edge of the plasma by magnetic fusion scientists. Recently this interest has intensified because of clear evidence that the quality of the central plasma confinement depends in unexpected ways on details of how the edge plasma is managed. Significant efforts are being pursued to understand and exploit the improved plasma confinement observed in the 'H-mode' obtained with divertors and in the 'super-shots' obtained with low neutral particle flux from the edge of TFTR limiter plasmas. The controls, that determine whether or not these well-confined plasmas are obtained, are applied in the edge plasma where a wealth of atomic and molecular processes occur. A qualitative overview of current research related to plasma edge and desirable features is presented to guide thoughts about atomic processes to be included in modeling and interpreting the plasma edge of tokamaks.

13729 **Confinement studies of neutral beam heated discharges in TFTR.** Murakami, M.; Bell, J.D.; Arunasalam, V. (Princeton Univ., NJ, USA. Plasma Physics Lab.; Oak Ridge National Lab., TN, USA). *Plasma Physics and Controlled Fusion;* **28**: No. 1A, 17-27(Jan 1986). (CONF-850927—).

From 12. European conference on controlled fusion and plasma physics; Budapest, Hungary (2 Sep 1985).

The TFTR tokamak has reached its original machine design specifications (Isub(p)=2.5 MA and Bsub(T)=5.2T). Recently, the D^0 neutral beam heating power has been increased to 6.3 MW. By

operating at low plasma current (Isub(p) approx. 0.8 MA) and low density (n-barsub(e) approx. 1 x $10^{19}m^{-3}$), high ion temperatures (9 +- 2 keV) and rotation speeds (7 x 10^{5} m/s) have been achieved during injection. At the opposite extreme, pellet injection into high current plasmas has been used to increase the line-average density to 8 x 10^{19} m^{-3} and the central density to 1.6 x 10^{20} m^{-3}. This wide range of operating conditions has made possible scaling studies of the global energy confinement time in both ohmically and beam heated discharges as well as more detailed transport studies of the profile dependence.

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REFER ALSO TO CITATION(S) 10947, 11479, 11480, 11847, 13513, 13629, 13720, 13726

13730 (AD-A—185005/6/XAB) Theory of induced spatial incoherence. Interim report. Lehmberg, R.H.; Schmitt, A.J.; Bodner, S.E. (Naval Research Lab., Washington, DC (USA)). 16 Sep 1987. 60p. (NRL-MR—5980). NTIS, PC A04/MF A01.

This paper describes theoretical and experimental investigations of induced spatial incoherence (ISI), a technique for achieving the smooth and controllable target beam profiles required for direct-drive laser fusion. Analytic and numerical calculations show that nonuniformities due to interference among the beamlets are smoothed by both thermal diffusion and temporal averaging. Under laser-plasma conditions of interest to ICF, average ablation pressure nonuniformities about 1% should be readily attainable. A partial ISI scheme, which allows widely-spaced beamlets to remain mutually coherent, is examined with the resulting high spatial frequency interference structure can be effectively smoothed by thermal diffusion alone. A perturbation analysis shows that the average target profile <I(x)> remains relatively insensitive to laser beam aberration when the scalelength of that aberration is larger than the initial beamlet width. This aberration will tend to broaden and smooth <I(x)>, rather than introduce any small-scale structure. The broadening is largely controllable because it depends only upon spatial averages of the aberrated quantities over the entire laser aperture; the uncontrollable perturbations can be reduced to about 1% in practical cases.

13731 (BARC—1352) Study of two medium size 'C' core electromagnets generating low magnetic fields. Bhatia, M.S.; Dass, S.; Chatterjee, U.K. (Bhabha Atomic Research Centre, Bombay, India. Multidisciplinary Research Scheme; Bhabha Atomic Research Centre, Bombay, India. Laser Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701237/JAW.

Magnetic field requirements of laboratories may impose constraints that often call for a variety of non-standard designs. The designer has to fulfil these demands without letting the design to become too inefficient. Since no ready design procedures are available he has to resort to intuition calculation and modelling. In spite of this there may be wide discrepancy between the design values and the actual results. This report describes the experience gained on two 'C' core electromagnets being used by authors. These magnets generate low magnetic fields over reasonably large volumes, a requirement that runs opposite to that of most other magnets. The study reveals the dependence of overall performance efficiency, field uniformity etc. on the design parameters. 31 figures.

13732 (CLM-R—275) On the radiological behaviour of first wall fusion structural materials. Giancarli, L. (UKAEA Culham Lab., Abingdon). Feb 1987. 36p. H. M. Stationery Office, London, price Pound 5.00.

The present report examines the radiological behaviour of low-activity structural materials for the first wall and blanket of nuclear fusion reactors. In this context the allowable concentration limits for all the stable elements are discussed for the neutron irradiation conditions of commercial fusion reactors. Some long-term activation properties of low-activity alloys proposed as structural materials are determined and methods of reducing their residual radiological hazard are examined. The way in which the accuracy of the results depends on the completeness and the uncertainty associated with the neutron cross-section data is discussed and some examples are given of relatively poorly-defined reaction cross-sections the values of which could have important implications for the conclusions.

13733 (CNIC—00034) Internal protection of subdivision for superconducting magnets. Wang Jinxing; Li Ruilin; Chu Jun. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 9p. (In Chinese). (SIP—0013). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700946/JAW.

The method of design and experimental results on internal protection of subdivision for supreconducting magnets are described with an example of a superconducting magnet which has a 16 cm bore and an axial field of 4.9 T. The velocity of propagation of a normal spot in a composite superconductor is derived and its variation calculated for a particular conductor example. This is used to compute heat generation, temperature, resistivity and resistance increases and current decay, in order to determine the minimum number of subdivisions and the shunt resistance required to limit the maximum temperature rise to an accegtable value. The internal protection of subdivision is applicable fro high current density, operating in the persistent mode or large inductance superconducting magnets. Its advantages are simple, dependable and cheap. But its disadvantage is consuming large quantities of helium.

13734 (CNIC—00035) Development of a supperconducting magnet system for the 8 mm gyrotrone tube. Zhu Xuewu; Cheng Benpei; Chen Jian; Pu Men; Li Yuezhen and others. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 6p. (In Chinese). (SIP—0014). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700947/JAW.

Development of a superconducting magnet system for the 8 mm gyrotrone tube is discribed in this paper. Magnetic field at the axis of its main field coil has reached 2.14 T. Length of uniform region is 14.5 cm Degree of uniformity is +-3.84per mille. It could be operated in persistent mode by means of superconducting switch. Length of uniform region of the secondary field coil is 4.5 cm. Degree of uniformity is +-1.43per mille. Dewar vessel has a home temperature bore in step mode. The upper section diameter is 74 mm and the lower section is 140 mm. The average liquid helium boil-off rate of dewar vessel with superconducting magnet is 4 L/h.

13735 (CNIC—00037) Minimum energy reversed field pinch configuration for finite Beta. Zhang Peng. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 7p. (In Chinese). (SIP—0016). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700948/JAW.

The reversed field pinch configuration has been studied in case of finite beta. Suydam's condition and the sufficient stability criterion have been used to examine this configuration. The results of numerical calculations shows that the critical value of the appearance of the reverse toroidal field increases as the β-value increases. The critical helical state of relaxation increases with β as well. Suydam's and Robinson's stability regions shifts towards the region in which Θ increases with the β values. The theoretical results with finite β coincides with recent RFP'S experimental results.

13736 (CNIC—00041) Power supply system for high current neutral beam source. Wang Detai; Shang Zhenkui. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 6p. (In Chinese). (SIP—0020). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700952/JAW.

A P.S. (Power Supply) for multi-filament neutral beam source with an extraction area of 7 x 35 cm/sup 2/ is described briefly. It includes plasma generator P.S., accelerator P.S., suppresor P.S. and control system. SCR thyristors of the switch modulator are applied to an are P.S. which is capable of delivering 1 to 5 kA pulses current at 20 to 150 V and pulse length of 50 ms from a twelve pulse rectifier of the P.S. system to supply energy to the are chamber load with the duty cycle of 0.1%. Both of switching-no

and switching-off time of the circuit are less than 1 ms. The most impurtant feature of the accelerator P.S. is the abolishment of the parallel fast crowbar switch. In order to increase reliability, two pieces of the FU-104Z type tetrode tube in series were used and each tube can stand the maximum static DC voltage. To improve the fast response of both interrupt and regulation of the overall system, the regulation and switching functions are separated so that they will not interact on each other. The P.S. system is controlled by DBJ-Z80 microcomputer. It has been running reliably under strong electromagnetic field perturbations.

13737 **(CNIC—00042) Calculation and pretest of power supply for creating toroidal field in HL-1 tokamak.** Xiong Zirong; Ren Juqian; Miao Jiaqi; Xie Yongzhong; Chu Xiuzhong; Yu Xianrong; Zeng Shujun; Xie Jiangfu; Tang Huiting. (Southwest Inst. of Physics, Leshan, SC, China). (China Nuclear Information Centre, Beijing, BJ). 1987. 11p. (In Chinese). (SIP—0021). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88700953/JAW.

In this paper, the numerical calculation and test results of synchronization of two pulse generators with flywheel, which are to be used for power supply to create toroidal magnetic field in HL-1 Tokamak device, are described. During the synchronization, the transient waveform of toroidal magnetic field, which is energized by 8-bridge rectifier, are taken in graphics, and the expectant operation performance is considered. The improvements involved energy conservation, safe operation and reliability of HL-1 are also discussed.

13738 **(CONF-8710215—1-Vugraphs) Modeling considerations for selected rf-plasma edge effects.** Hogan, J.T. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003285/JAW.

From ICRF/edge physics workshop; Oak Ridge, TN, USA (6 Oct 1987).

This paper contains viewgraphs on the following topics: SOL modeling in iron core machines requiring a two-dimensional description; charge exchange of H^0 with carbon of rf antennas; and self-sputtering of antennas by emitted and sheath-accelerated carbon and Textor/Tore Supra tokamak plasma edge effect models. (LSP)

13739 **(DOE/ET/52025—T1) [Fusion Studies Program].** (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering). 1987. Contract AS05-78ET52025. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002775/JAW.

This paper contains short discussions of impurity control methods and transient electromagnetics in tokamak plasmas. Discussed are neutral beam driven impurity flow reversal, radial momentum transfer, ECR heating driven impurity flow reversal, limiter and divertor location. 7 refs. (LSP)

13740 **(EUR-CEA-FC—1332) Metallic plates lens focalizing a high power microwave beam.** Rebuffi, L. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Aug 1987. 66p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88751853/JAW.

A metallic grating composed of thin parallel plates opportunely spaced, permits to correct the phase of an incident high power microwave beam. In this work we show how it is possible to obtain a beam focalisation (lens), a beam deflection (prisma), or a variation in the polarization (polarizer) using parallel metallic plates. The main design parameters are here presented, in order to obtain the wanted phase modification keeping low the diffraction, the reflected power, the ohmic losses and avoiding breakdowns. Following the given criteria, a metallic plate lens has been realized to focalize the 200 KW, 100 msec 60 GHz beam used in the ECRH experiment on the TFR tokamak. The experimental beam concentration followed satisfactory the design requirements. In fact, the maximum intensity increased about twice the value without lens. In correspondence of this distance a reduction of the beam size of about 50% have been measured for the -3 dB radius. The lens supported high power tests without breakdowns or increase of the reflected power.

13741 **(IAE—4364/7) Study on compact torus transport in a magnetic system with a conical turn.** Goloviznin, V.M.; Krylov, S.F.; Kurtmullaev, R.Kh.; Semenov, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701034/JAW.

Compact torus (CT) transport method, applying inhomogeneous external magnetic field of a conical solenoid, is investigated. Numerical simulation was aimed at obtaining a detailed picture of CT formation and acceleration processes under minimal value of conicity ratio, equal to 1.1, and evaluating the applicability of the main characteristics: comparative shock heating and acceleration efficiency, the degree of oscillatory perturbations and torus structure changes. A cone angle, under which toroid formation and acceleration occur simultaneously, with the energy of the ordered motion making up ~ 10% of plasma thermal energy, is found. It is shown, that under the chosen conical turn shape it is possible to effectively heat the toroid by shock waves as in the cylindrical case, and to smoothly accelerate it in the direction of injection up to the needed rate for the time of the field rise. In this case the degree of oscillatory perturbations is low. 7 refs.; 6 figs.

13742 **(INIS-BR—897, pp 107) Generation of compact torus configuration by rotating magnetic fields.** Kulnapfel, M.; Stampa, A.; Tabersky, R.; Tuczek, H. (Essen Univ., Gesamthochschule, Germany, F.R.). 1987. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88700657/JAW. (CONF-8708185—).

From Energy independence conference: fusion energy and plasma physics; Rio de Janeiro, RJ, Brazil (17 Aug 1987).

13743 **(INIS-mf—11089, pp 73) Recent developments in engineering and technology concepts for prospective tokamak fusion reactors.** Ford, G.W.K. (New South Wales Univ., Kensington, Australia. School of Mechanical and Industrial Engineering). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13744 **(INIS-mf—11089, pp 57) Experimental effect of varying the rotational transform in the SHEILA heliac.** Hamberger, S.M.; Shi, X.H.; Blackwell, B.D.; Sharp, L.E. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13745 **(INIS-mf—11089, pp 58) Optimization of magnetic design for large heliac H-1.** Sharp, L.E.; Blackwell, B.D. (Australian National Univ., Canberra. Plasma Research Lab.). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13746 **(INIS-mf—11089, pp 29) Time-resolved population densities in metal vapour lasers.** McIntosh, A.I.; Brown, D.J.W.; Kunnemeyer, R.; McLucas, C.W. (New England Univ., Armidale, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13747 **(INIS-mf—11089, pp 64) Space-charge effects in the RF breakdown of CO/sub 2/ gas laser mixtures.** Morrow, R. (Commonwealth Scientific and Industrial Research Organization, Lindfield, Australia. Div. of Applied Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13748 (INIS-mf—11089, pp 82) **New metal vapour laser : sputtering discharge in a rapid gas flow.** Anders, A.K.; Harvey, E.C.; Tobin, R.C. (Monash Univ., Clayton, Australia. Dept. of Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13749 (INIS-mf—11089, pp 88) **Laser generation in the noble gas mixtures and metal vapors.** Apollonov, V.V.; Derzhavin, S.I.; Prokhorov, A.M.; Sirotkin, A.A. (General Physics Institute, Academy of Sciences, Moscow, USSR). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13750 (INIS-mf—11089, pp 89) **High volume self-sustained discharge laser applications.** Apollonov, V.V.; Prokhorov, A.M.; Firsov, K.N. (General Physics Institute, Academy of Sciences, Moscow, USSR). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13751 (INIS-mf—11089, pp 90) **Inert gas mixture lasers pumped by optical breakdown.** Prokhorov, A.M.; Apollonov, V.V.; Derzhavin, S.I.; Sirotkin, A.A. (General Physics Institute, Academy of Sciences, Moscow, USSR). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13752 (INIS-mf—11089, pp 87) **Volume ignition calculations of laser compressed pellets.** Szichman, H.; Cicchitelli, L.; Hora, H.; Miley, G.H. (New South Wales Univ., Kensington, Australia. Dept. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88700825/JAW. (CONF-870207—).

From 16. plasma physics conference; Lucas Heights, Australia (9 Feb 1987).

13753 (KMSF-U—1877) **The deposition rate dependence of plasma polymerization on the radius of curvature of the substrate.** Lintz, H.K.; Murrell, S.R.; Crawley, R.L.; Daukas, J.C. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1987. Contract AC08-87DP10560. 15p. (CONF-871125—16). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003811/JAW.

From 34. national vacuum symposium and topical conference; Anaheim, CA, USA (2 Nov 1987).

In the plasma polymerization deposition of CH/sub x/ onto microspherical Inertial Fusion targets we have found that the coating rate varies with substrate diameter. Spherical shells ranging in diameter from 100 to 1000 microns were coated with several microns of plasma polymerized trans-2-butene under identical conditions and their coating thicknesses measured interferometrically. We found that the coating rate variation with shell radius could be described by an equation having the form $dr/dt = A/(R + r) + B$ where dr/dt is the coating rate, R the initial sphere radius, r the coating thickness, and A and B parameters related to the plasma conditions. We also found that there exists a functional relationship between the parameters A and B which is dependent on the rf power density. A model has been developed to show how this observed rate dependence relates to the buildup of an electrical charge on the nonconducting substrate surface. The electric field which arises is dependent on the radius of curvature of the substrate and in turn affects the contribution to the film growth by the ionized species impinging upon the surface. Neutral species arriving at the surface are not affected and thus lead to the B term in the empirical form of the rate dependence. 3 refs., 3 figs.

13754 (NIIEFA-P-E—0746) **Method of computation of helium flow dynamics in channels of hollow superconducting wire under pulsed and variable heat loads.** Volkov, A.F.; Kalinin, V.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1986. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701400/JAW.

A method to solve numerically nonstationary equation system of heat conductivity of a hollow superconducting current-carrying element and gas dynamics of helium flow in its channels under variable and pulsed heat loads is suggested which is based on the method of "large particles". Examples of helium behaviour computation in channels during fast (emergency) energy release and pulsed thermal perturbations for superconducting wire of toroidal field of the "Tokamak-15" device are provided. 6 refs.; 6 figs.

13755 (ORNL/TM—10222) **Evaluation of magnetic coordinates in finite-beta, asymmetric plasmas.** Beasley, C.O.; Rome, J.A.; Attenberger, S.E.; Hirshman, S.P. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003665/JAW.

Analytical and numerical stability or transport calculations for toroidal plasmas are facilitated by using flux coordinates in which the magnetic field lines are straight. A published method for obtaining these magnetic coordinates, or more specifically the Fourier components of the magnetic field in this coordinate system, has existed for a vacuum magnetic field. A procedure for calculating these components for a finite-β plasma equilibrium, however, has not previously been available. (Here, β is the ratio of plasma pressure to magnetic pressure.) In this report, we describe such a procedure, in which we start with an arbitrary-β magnetic equilibrium for which nested toroidal flux surfaces exist and obtain the Fourier components of the magnetic field in straight-line magnetic coordinates. We describe the various numerical procedures, referring to published documentation where needed. We then document the codes involved and apply them to a specific toroidally nonsymmetric, finite-β plasma. 8 refs., 3 figs.

13756 (PNL-SA—15276) **Irradiation testing of tritium breeding solids in fission reactors by isotopic tailoring to the neutron spectra.** Hollenberg, G.W.; Kondo, T.; Watanabe, H.; Kurasawa, T.; Puigh, R.J.; Reuther, T.C. (Pacific Northwest Lab., Richland, WA (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki; Westinghouse Hanford Co., Richland, WA (USA); USDOE, Washington, DC). Sep 1987. Contract AC06-76RL01830. 12p. (CONF-871036—25). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003946/JAW.

From 3. international conference on fusion reactor materials; Karlsruhe, F.R. Germany (4 Oct 1987).

The absence of a high fluence, fusion neutron source requires that fission reactors be used to evaluate tritium breeding solids and blanket design concepts. The strong dependence of the cross section for the $^6Li(n,He)^3T$ reaction on neutron energy gives an opportunity for a high degree of flexibility in utilizing both mixed spectrum and fast neutron reactors to approximate the fusion blanket environment. Critical factors in the simulation of the blanket environment may best be characterized by the tritium generation rate, the heat generation rate and spatial and temporal gradients in temperature and burnup. Furthermore, irradiation damage to solid breeder materials may be dominated by lithium burnup because of the extrinsic nature of transmutation products and the large number of recoil displacements. The accessibility and availability of water cooled, mixed spectrum, neutron reactors along with their low temperature coolant have led to numerous in situ tritium recovery tests in these reactors. However, the large thermal neutron cross section of the ^6Li reaction results in an irradiation environment in which neutronic effects including selfshielding and burn out lead to a poor simulation of engineering conditions relevant to blanket designs. Utilization of depleted ^6Li and/or thin rings has been done to minimize these effects. Establishment of design relevant temperature gradients and tritium production profiles can be particularly difficult in larger volume experiments in mixed spectrum reactors. Spectral tailoring of mixed spectrum reac-

tor or use of fast neutron reactor provides an effective alternative to avoid these testing limitations. 4 refs., 4 figs.

13757 **(RISO-M—2657) Effect of ablatant composition on the ablation of a fuelling pellet.** Chang, C.T.; Thomsen, K.; Piret, S. (Risoe National Lab., Roskilde (Denmark)). Sep 1987. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751479/JAW.

The single species neutral-shielding model for the ablation of a hydrogenic pellet is extended by considering the ablatant as a mixture of four species: molecular and atomic hydrogen, protons and electrons. Compared with the results of the frozen flow, (i.e. the single species molecular hydrogen gas model), results of the analysis showed that the presence of dissociation and ionization effects caused a marked difference of the ablatant state. The attenuations of the incoming electron energy and energy flux, however, are very much similar irrespective of whether the ablated flow is in a frozen or an equilibrium state. The scaling law of the pellet ablation rate with respect to the plasma state of T/sub e/, n/sub e/ and the pellet radius remains the same; the ablation rate is reduced by approximately 15%. To examine the possible existence of a spherical shell around the pellet where most of the incoming electron energy is absorbed, a comparison is made between the local electron collisional mean free path and the electron Larmor radius. A critical field at the ionization radius is evaluated. An effective spherical energy-absorbing region exists when the local field strength is below the critical value. For a plasma state of low T/sub e/ and n/sub e/, (where the ablatant is hardly ionized), and for one near the thermonuclear condition (where a highly dense ablatant exists near the pellet), the effective energy absorption region is nearly spherical. In view of the variation of the plasma temperature and density as well as the pellet radius during the penetration of a pellet in a tokamak discharge, the existence of such an effective spherical energy absorption region still requires further exploration. 20 refs.

13758 **(UCID—21258) Resolution limitations and optimization of the ITT F4157 streak tube focus for fast (10 ps) operation.** Lerche, R.A.; Grasz, E.L.; Griffith, R.L.; Simpson, R.A.; Posey, R. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003727/JAW.

The ITT F4157 image tube is biased at voltages far from the original design for operation in an ultrafast (10 ps) streak camera. Its output resolution at streak camera operating potentials has been measured as a function of input slit width, incident-light wavelength, and focus-grid voltage. The results are similar to those reported for the RCA C73435 streak tube. Indeed, the two tubes can be substituted for each other with minor mechanical modifications. The temporal resolution is insensitive to focus-grid voltage for a narrow (50 μm) input slit, but is very sensitive to focus-grid voltage for a wide (500 μm) input slit. Spatial resolution is nearly independent of focus-grid voltage for values that give good temporal resolution. Both temporal and spatial resolution depend on the incident-light wavelength. Streak camera operation is simulated with a computer program that calculates photoelectron trajectories. Electron ray tracing describes the observed effects of slit width, incident-light wavelength, and focus-grid voltage on the output resolution. 6 refs., 10 figs., 1 tab.

13759 **(UCRL—15923) Burst mode Nd:YLF laser oscillator: Eighth and final monthly progress report.** Kimberland, S. (XMR, Inc., Santa Clara, CA (USA)). Mar 1987. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004040/JAW.

This report discusses the costs, status of equipment and limited performance of the burst mode Nd:YLF laser. (LSP)

13760 **(UCRL—15978) ICF special studies: Final report.** Meier, W.R. (Schafer (W.J.) Associates, Inc., Pleasanton, CA (USA)). 16 Sep 1987. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88004057/JAW.

This paper summarizes the work completed by W.J. Schafer Associates for Lawrence Livermore National Laboratory in the area of Inertial Confinement Fusion. The SAFIRE (Systems Analysis Code for ICF Reactor Economics) code is one of the major tasks discussed. (LSP)

13761 **(UCRL—97420) Spatially resolved x-ray laser spectra and demonstration of gain in nickel-like systems.** Whelan, D.A.; Keane, C.J.; MacGowan, B.J.; Matthews, D.L.; Trebes, J.E.; Eckart, M.J. (Lawrence Livermore National Lab., CA (USA)). 25 Sep 1987. Contract W-7405-ENG-48. 9p. (CONF-8708110—29). NTIS, PC A02. Order Number DE88003957/JAW.

From 31. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA, USA (16 Aug 1987).

A recent series of experiments have provided spatially resolved near field images of several candidate x-ray lasing transition in neon-like, nickel-like, and hydrogen-like ions from laser-produced plasmas. From these time-gated, spatially, and spectrally resolved measurements the source size for the J = 0 - 1 and the J = 2 - 1 transitions in Ne-like selenium have been determined. Source regions as small as 50 μm have been observed on transitions with gain-length products >9. In addition, we have obtained the first experimental evidence for the amplification of spontaneous emission in the nickel-like ions of europium and ytterbium. Gains of order 1 cm^{-1} and gain-length products of up to 3.8 are observed on the J = 0 - 1, 4d-4p transitions in Eu + 35 at 65.26 and 71.00 A. Analogous transitions in Yb = +42 have been identified and some evidence for ASE has been observed. 7 refs., 11 figs.

13762 **Neoclassical diffusion of heavy impurities in a rotating tokamak plasma.** Wong, K.L.; Cheng, C.Z. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Physical Review Letters;* 59: No. 23, 2643-2646(7 Dec 1987). Contract AC02-76CH03073.

Particle orbits in a rotating tokamak plasma are calculated from the equation of motion in the frame that rotates with the plasma. It is found that heavy particles in a rotating plasma can drift away from magnetic surfaces significantly faster, resulting in a diffusion coefficient much larger, than for a stationary plasma. Particle simulation is carried out and the results offer a qualitative explanation for some experimental data from the Tokamak Fusion Test Reactor.

13763 **Economic considerations of commercial tokamak options.** Dabiri, A.E. (Fusion Engineering Design Center/SAIC, Oak Ridge National Lab., P.O. Box Y, Oak Ridge, TN 37831). *Fusion Technology;* 12: No. 2, 238-248(Sep 1987). Contract AC05-84OR21400.

Systems studies have been performed to assess commercial tokamak options. Superconducting, as well as normal, magnet coils in either first or second stability regimes have been considered. A spherical torus (ST), as well as an elongated tokamak (ET), is included in this study. The cost of electricity (COE) is selected as the figure of merit, and beta and first-wall neutron wall loads are selected to represent the physics and technology characteristics of various options. The result indicates that the COE of an ET or ST device operating with the same technology requirement (wall load) as a superconducting magnet tokamak is about the same as the COE of a superconducting magnet tokamak in the second stability regime. Therefore, a device like ST or ET appears more attractive in ratings lower than 1200 MW(electric).

13764 **Transport of intense ion beams.** Lee, E.P. (Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research;* 258: No. 3, 576-582(15 Aug 1987). (CONF-860520—). Contract AC03-76SF00098.

From Conference on charged particle optics; Los Alamos, NM, USA (19 May 1986).

The maximum transportable current for an ion beam is determined by considerations of focal strength, space charge equilibrium and stability, structural practicality, and emittance. These factors are described within the context of a heavy ion driver for inertial confinement fusion. Recent supporting results from particle-in-cell simulations and transport experiments will be described.

13765 **Engineering considerations for the Tore Supra pump limiter.** Whitley, J.B.; Koski, J.A.; Aymar, R. (Sandia National Labs., Albuquerque, NM 87185). pp 627-636 of Fusion technology 1986. Elmsford, NY; Pergamon Books Inc. (1987). (CONF-860917—). Contract AC04-76DP00789.

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

The Tore Supra pump limiter project is a collaboration between Sandia National Laboratories and Oak Ridge National Laboratories in the U.S. and the Association Euratom-CEA at Cadarache, France. The long pulse length and high power levels of Tore Supra, coupled with the desire to remove the maximum practical number of particles, have driven the pump limiter design beyond that ever before experienced. The engineering considerations going into this design are reviewed and several preliminary designs are discussed.

13766 **The Tara control, monitoring, data acquisition, and analysis system.** Sullivan, J.D.; Gaudreau, M.P.J.; Blanter, B.; Fredian, T.W.; Irby, J.H.; Karcher, C.A.; Rameriz, R.; Sevillano, E.; Stillerman, J.; Thomas, P. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, MA 02139). pp 1491-1498 of Fusion technology 1986. Elmsford, NY; Pergamon Books Inc. (1987). (CONF-860917—).

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

Experiments at the MIT Tara Tandem Mirror utilize an integrated system for control, monitoring, data acquisition, physics analysis, and archiving. This system consists of two distinct parts with narrowly defined information interchange; one to provide automated control and real time monitoring of engineering functions and one to acquire, analyze, and display data for physics in near real time. Typical machine operation achieves a total cycle time of 3 to 8 minutes with 5 to 7 Mbytes of data stored and with —160 individual signals displayed in hardcopy on —10 pages.

13767 **Fusion breeder blanket nucleonics.** Lee, J.D. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5511, L-644, Livermore, CA 94550). pp 321-325 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract W-7405-ENG-48.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

Refined nuclear analysis, including the treatment of resonance and spatial self-shielding, coupled with an optimization procedure, has resulted in improved performance estimates for two conceptual fission-supressed blankets. Net specific breeding in these two blankets maximized at 0.024 and 0.023 U-233 atoms/MeV, which is about an order of magnitude higher than in fission breeders.

13768 **Production of muons for fusion catalysis in a magnetic mirror configuration.** Moir, R.W.; Chapline, G.F. (Lawrence Livermore National Lab., Livermore, CA 94550). pp 185-192 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract W-7405-ENG-48.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

For muon-catalyzed fusion to be of practical interest, a very efficient means of producing muons must be found. The authors describe a scheme for producing muons that may be more energy efficient than any heretofore proposed. There are, in particular, some potential advantages of creating muons from collisions of high energy tritons confined in a magnetic mirror configuration. If one could catalyze 200 fusions per muon and employ a uranium blanket that would multiply the neutron energy by a factor of 10, one might produce electricity with an overall plant efficiency (ratio of electric energy produced to nuclear energy released) approaching 30%.

13769 **MINIMARS, a 600-MWe advanced mirror-fusion reactor design.** Lee, J.D.; Logan, B.G. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5511, L-644, Livermore, CA 94550). pp 21-25 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract W-7405-ENG-48.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

MINIMARS is a conceptual fusion reactor based on tandem-mirror magnetic confinement. It is designed to produce 600 MW net electric for 41 mils/kWh and to be capable of passive shutdown and afterheat removal.

13770 **The compact torus plasma ring accelerator - A new type driver for inertial confinement fusion.** Hartman, C.W.; Eddleman, J.L.; Hammer, J.H.; Meeker, D.L. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5511, Livermore, CA 94550). pp 158-161 of Emerging nuclear energy systems. Velarde, G.; Minguez, E. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860601—). Contract W-7405-ENG-48.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

The authors discuss the acceleration of magnetically-confined plasma rings to provide a driver for ICF. The acceleration of plasma rings is predicted to be efficient and following focusing, to generate ion-bombardment power in the range 10/sup 15/-10/sup 16/ W/cm/sup 2/ at a total deposition energy of multimegajoules. The simplicity of plasma ring accelerator suggests that a 5 MJ (on target) driver would cost in the range 1-5 $/joule. First experimental tests of the accelerator are described.

13771 **High energy krypton fluoride amplifiers for laser-induced fusion.** Sullivan, J.A.; Rosenberg, C.W. von. (Los Alamos National Lab., NM, USA; Avco-Everett Research Lab., Inc., Everett, MA, USA). *Laser and Particle Beams;* 4: No. 1, 91-105(Feb 1986). (CONF-850558—).

From Conference on lasers and electro-optics; Baltimore, MD, USA (21 May 1985).

The general requirements for inertial confinement fusion, technology requirements and choices, overall efficiencies, and laser system costs for scaling krypton fluoride amplifiers to high energy are discussed and the design of a 100 kilojoule double-pass KrF power amplifier is described.

13772 **Photoconductive switch pulse shaping device for the Nova master oscillator.** Wilcox, R.B. (Lawrence Livermore National Lab., CA, USA). *Laser and Particle Beams;* 4: No. 1, 141-143(Feb 1986). (CONF-850558—).

From Conference on lasers and electro-optics; Baltimore, MD, USA (21 May 1985).

Compensation is made for gain saturation in the Nova amplifiers by producing shaped input optical pulses. A silicon switch device generates kilovolt electrical pulses for driving Pockels cells. The pulse shape is easily controllable with subnanosecond resolution.

13773 **Overview of Aurora: a multi-kilojoule KrF laser system for inertial confinement fusion.** Rosocha, L.A.; Bowling, P.S.; Burrows, M.D.; Kang, M.; Hanlon, J.; McLeod, J.; York, G.W. (Los Alamos National Lab., NM, USA). *Laser and Particle Beams;* 4: No. 1, 55-70(Feb 1986). (CONF-850558—).

From Conference on lasers and electro-optics; Baltimore, MD, USA (21 May 1985).

Aurora is a short-pulse high-power krypton-fluoride laser system that serves as an end-to-end technology demonstration prototype for large-scale ultraviolet laser systems of interest for short wavelength inertial confinement fusion (ICF) studies. The system is designed to employ optical angular multiplexing and serial amplification by electron-beam-driven KrF laser amplifiers to deliver 248 nm, 5-ns duration multi-kilojoule laser pulses to ICF targets using a beam train of approximately 1 km in length. The goals for the system are discussed and the design features of the major system

components: front-end lasers, amplifier train, and the alignment and controls systems are summarised.

13774 **Small fusion reactors: problems, promise, and pathways.** Krakowski, R.S.; Hagenson, R.L.; Miller, R.L. (Los Alamos National Lab., NM, USA). pp vp of Fusion technology 1984. Volume 1 of 2. Proceedings of the thirteenth symposium. Conference centre of Villa Ponti, Varese, Italy, 24-28 September 1984 . Oxford, England; Pergamon Press (1984). (EUR—9183-EN; CONF-840915—).

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

The vision of magnetic fusion as a central-station power plant projects a high-technology, low-power-density nuclear boiler that may require generally high energy costs to be economically competitive. Smaller, higher-power-density approaches can reduce the impact of the fusion power core and associated support equipment on the overall cost equation for fusion. The issues related to these more compact systems are addressed on the basis of simplified, generic reactor models.

99 GENERAL AND MISCELLANEOUS

13775 (CONF-8704175—) **Proceedings of the international conference on security documents for the 21st century.** Burnett, M.N.; Sexton, N.A.; Goodman, C.A.; Johnson, C.K.; McNaull, R.M.; Graminski, E.L.; Seidel, M.J. (eds.). (Oak Ridge National Lab., TN (USA); Bureau of Engraving and Printing, Washington, DC (USA)). 1987. Contract AC05-84OR21400. 174p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

The papers in this volume give conservative projections on future requirements from the users of security documents. Printers of security documents give requirements for advanced technologies. Design requirements for ink technology, counterfeit detection, and optical features in security documents are given. Costs of the new technologies are discussed. One thing that can be seen from this volume, according to the moderator of the conference, is the widespread desire to use some sort of optical device in future security documents. Thirty analytics were prepared for the sections of this report. (JDH)

13776 (CONF-8704175—, pp 5-6) **The real challenge: Technology and security documents: Keynote address.** DeBose, J.M. Jr. (Bureau of Engraving and Printing, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

13777 (CONF-8704175—, pp 7-12) **The role of currency in the economy.** Schroeder, F.J. (Board of Governors of the Federal Reserve System, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper discusses the role of banknotes in the US economy. Data are presented on how individuals use banknotes and from where they obtain paper currency. Supply and demand of banknotes is discussed and forecasted. 8 figs. (JDH)

13778 (CONF-8704175—, pp 13-14) **The present situation of the settlement system in Japan.** Sugimoto, Kazuhiko. (Bank of Japan, Tokyo). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper discusses the use of cash, credit cards, and "prepaid" debit cards in Japan. (JDH)

13779 (CONF-8704175—, pp 15-18) **Counterfeiting of security documents in the twenty-first century.** Hall, T.M. (US Secret Service, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper contains a discussion concerning methods used by counterfeiters to produce banknotes and other types of documents. Ways of producing currency, credit cards, and other items in the future so as to prevent counterfeiting are mentioned. (JDH)

13780 (CONF-8704175—, pp 19-21) **Future operational uses of postal documents.** Peyrie, A. (Imprimerie des Timbres-Poste, Perigueux-Boulazac, France). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper presents a description of the way postage stamps are produced in France. (JDH)

13781 (CONF-8704175—, pp 22-35) **Recent developments in the electronic banking and payment system in Thailand: A case study of a developing country.** Supinit, V. (Bank of Thailand, Bangkok). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This report describes current trends in the banking industry in Thailand. In this developing country, electronic banking is just now being introduced. The effects of new methods of banking on the economy and population are discussed. 7 figs., 3 tabs. (JDH)

13782 (CONF-8704175—, pp 36-41) **Do postage stamps have a 21st century future?.** Morison, G.C. (United States Postal Service, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

The reasons for the success of the postage stamp are investigated in this paper. (JDH)

13783 (CONF-8704175—, pp 42-43) **The two-sided view of note printing in the twenty-first century.** Lelahuta, S. (Bank of Thailand, Bangkok). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

We in security printing are aware that modern developments in commercial printing and other reproducing techniques have made available the technology and know-how of producing in various ways printed matter that appears similar to genuine banknotes and that will become even more similar in the time to come. One day, using present day banknotes, the counterfeiters will be able to use modern digital technology and advanced photochemical processes available in the nonsecurity sector to reproduce banknotes. The reproductions will be so much like the genuine ones that the so-called man on the street will carelesaly accept them. This paper discusses two main viewpoints. One is the general view of security printing in the twenty-first century; the other is security printing as seen by the Note Printing Works of the Bank of Thailand.

13784 (CONF-8704175—, pp 44-46) **Note printing in the year 2000: The viewpoint from a note printer.** Nitidandha-Prabhas, O. (Bank of Thailand, Bangkok). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper discusses ways to prevent banknote counterfeiting. Topics covered are: (1) advanced printing presses; (2) sophisticated inks; (3) paper with integral security features. (JDH)

13785 (CONF-8704175—, pp 47-51) **Future production system requirements: What equipment will be needed to produce more sophisticated security documents?.** Rogers, T.J. (Bureau of Engraving and Printing, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This report mentions future technologies needed to produce banknotes, postage stamps, passports, identity cards, and similar documents. Items covered include printing presses, automated inspection equipment, distribution equipment, and physical design. An important area of interest is the computerized monitoring of production. (JDH)

13786 (CONF-8704175—, pp 52-55) **The introduction of new machine-readable identity cards to the Federal Republic of Germany.** von Gottberg, D.E. (Bundesdruckerei, West Berlin, Federal Republic of Germany). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper describes the new machine-readable identity cards introduced in West Germany. The reasons for the new card, how it is manufactured and distributed are discussed. (JDH)

13787 (CONF-8704175—, pp 56-58) **Some long-term future projects in the Fabrica Nacional de Moneda y Timbre.** Azpiazu, F. (Fabrica Nacional de Moneda y Timbre, Madrid, Spain). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

The Fabrica Nacional de Moneda y Timbre (FNMT) plans to undertake in the coming years the construction of a new plant for the manufacture of banknotes and other securities. The objective of the aforementioned plant is to combine traditional printing technologies, such as offset, intaglio, etc., either in sheet or bobbin, with modern computer-based technologies of production and control that are able to provide a high level of automation in banknote handling processes and production.

13788 (CONF-8704175—, pp 59-65) **Machine intelligence applications to securities production.** Johnson, C.K. (Oak Ridge National Lab., TN). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

The production of security documents provides a cache of interesting problems ranging across a broad spectrum. Artificial Intelligence (AI) methods can be used in conjunction with traditional scientific and computational methods to solve these problems. Fields, such as ink chemistry and technology, and machine inspection of graphic arts printing, offer interesting challenges that will continue to intrigue current and future generations of researchers into the twenty-first century. 3 figs.

13789 (CONF-8704175—, pp 66-69) **Future technical developments and trends in security documents.** Yoshijima, Shigetomo. (Ministry of Finance, Tokyo, Japan). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This report discusses the application of technological developments to prevent the counterfeiting of security documents. Topics covered include advanced inks, advanced printing presses, and computerized monitoring. (JDH)

13790 (CONF-8704175—, pp 70-81) **Postage stamps: The world's most carefully designed sales receipts.** McDowell, D.M. (United States Postal Service, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper describes how postage stamps are designed in the United States. 36 figs. (JDH)

13791 (CONF-8704175—, pp 82-86) **Optically variable devices for banknotes: Criteria for perception, durability, and security.** Rolfe, J. (Bank of Canada, Ottawa). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

In the Currency and Systems Research Section at the Bank of Canada, we keep watch on any promising technology that can be used to increase the security of Canadian banknotes. It is becoming increasingly difficult to find new technology in the traditional print technology used in banknotes, so other technologies are being increasingly investigated. A promising area has been generally designated "optically variable devices," often shortened to OVDs. These devices, when added to the traditional print technology of banknotes, provide a new dimension, namely a visual effect that varies when the banknote is viewed in two different directions. In this talk I will first describe the construction and operation of the OVDs that we have been thinking about, then I will describe the criteria that we have developed to grade the expected performance of each OVD, and finally I will give our evaluations of OVDs. 6 figs.

13792 (CONF-8704175—, pp 87-92) **The present and future role of design in banknote security.** Wotte, J. (Johannes Enschede En Zonen, The Netherlands). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

In the field of security printing, design tends to be underestimated in its contribution to the overall security of the product. Some believe that every design can be easily and deceptively reproduced by the forger using image-digitizing equipment of high resolution. This paper emphasizes the need for sophisticated design of banknotes to prevent forgery. The use of difficult to reproduce figures and multicolored inks are particularly important. Incorporation of metallic or colored threads in the banknote paper is also shown to be a useful technique. (JDH)

13793 (CONF-8704175—, pp 93-96) **Thoughts on design requirements for future security documents.** Desmond, J.L. (Bureau of Engraving and Printing, Washington, DC). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

The twentieth century has witnessed the challenge to printed security documents by reprographic technology, and this trend will continue. A framework has been presented here that can provide a useful way of examining the problem and finding solutions. A careful analysis of document susceptibility, technological effectiveness, and equipment availability need to be considered when designing future documents. Similarly, a clear understanding of threat and detector performance must be developed. Technology is overtaking the present methods for preventing unauthorized duplication or simulation of our products. We must act quickly to close the gap.

13794 (CONF-8704175—, pp 97) **Overall requirements of a security document.** Fridman, R. (AB Tumba Bruk, Stockholm, Sweden). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

13795 (CONF-8704175—, pp 98-100) **Futuristic graphic arts technology.** Prince, R.J. (Graphic Arts Technical Foundation, Pittsburgh, PA). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper discusses the future of the printing industry. Current markets are described and their potential for growth is mentioned. Technologies that will be important in the future are described. (JDH)

13796 (CONF-8704175—, pp 101-111) **New concepts for security documents, devices, and systems: Panel 1.** Graminski, E.; Barnes, R.D.; Defilet, F.; Rolfe, J.; Tunstall, J.; von Gottberg, D.E. (Bureau of Engraving and Printing, Washington, DC; Drexler Technologies, Mountain View, CA; Landis & Gyr Zug A.G., Switzerland; Bank of Canada, Ottawa; Intamic, Paris, France). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper contains several discussions on the future of security documents. The first topic covered is the use of optically variable devices (OVD's) on banknotes to ascertain their verity. The second topic is the use of ROM chips in sophisticated credit cards. Thirdly, the use of a new medium to store information on a card is discussed. The technology uses laser readable media similar to present Compact Discs. Another area covered is the use of advanced printing presses. Finally, the idea of using nonprint technology in banknotes to prevent counterfeiting is talked about. (JDH)

13797 (CONF-8704175—, pp 112-121) **Document authentication principles and systems: Panel 2.** Graminski, E.; Hall, T.; Ladefoged, E.; Warfel, G.; Young, A.T. (Bureau of Engraving and Printing, Washington, DC; United States Secret Service, Washington, DC; Interpol, Saint Cloud, France; Personal Identification News, Menlo Park, CA; Los Alamos National Lab., NM). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper treats several methods of identifying people. Topics included are: (1) current use of personal identification numbers (PIN's) on credit cards and banking cards; (2) automated fingerprint readers; (3) voice recognition devices; (4) biometrics; (5) signature and keyboard dynamics; and (6) automated scanning of identification papers. The main thrust of the paper is future developments of these and related ideas. 2 figs. (JDH)

13798 (CONF-8704175—, pp 122-127) **Production costs for the conventional and advanced security documents of the twenty-first century: Panel 3.** Bennett, C.W.; Addison, D.; Fridman, R.; Furley, R.J.; Kuhl, A. (Federal Reserve Board, Washington, DC; Reserve Bank of Australia, Victoria; AB Tumba Bruk, Stockholm, Sweden; Bank of England Printing Works, Loughton; Orell Fuessli Graphic Arts, Ltd., Zurich, Switzerland). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper is concerned with production and production costs for security documents. One section discusses the cost to society of prosecuting counterfeiters. (JDH)

13799 (CONF-8704175—, pp 128-133) **Security printing inks for the twenty-first century.** Allsopp, R. (SICPA Virginia, Inc., Springfield). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

An overview of the current situation in the industrialized environment in which we perform, particularly the securities printing industry and its support groups, directs me to note three of the most important considerations that we, the security ink manufacturer, must address as we move into the twenty-first century. These areas are security inks in relation to cost effectiveness, environmental protection, and security features through ink application.

13800 (CONF-8704175—, pp 134-140) **Design features and automated equipment for banknote production.** Giori, F.; Panofsky, T.; Kuehfuss, R. (De La Rue Giori, S.A., Lausanne, Switzerland; Machine Intelligence Corp., Sunnyvale, CA). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

In the twenty-first century, banknotes will be produced by two machines only: combined printing machines printing front and back and combined finishing machines verifying, numbering, cutting, and wrapping, all the processes being integrated into the MIS and the computer of the printing plant.

13801 (CONF-8704175—, pp 141-142) **New prospects in security systems.** Fancoli, F. (Instituto Poligrafico E Zecca Vello Stato, Rome, Italy). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

13802 (CONF-8704175—, pp 143-146) **Kinegrams: Optical variable devices for banknotes, security documents, and plastic cards.** Defilet, F. (LGZ Landis & Gyr Zug Corp., Switzerland). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper presents a method of protecting credit cards from counterfeiters. The technique involves use of light-diffracting microstructures to form an image that is difficult to copy. (JDH)

13803 (CONF-8704175—, pp 147-149) **Integrated circuit standardization and applications.** Tunstall, J. (Intamic, Paris, France). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper concerns plans for an integrated circuit credit card. Necessity of industry standards is explained and suggested standards are presented. Possible applications of the card are given: (1) debit card; (2) electronic traveler's checks; (3) electronic token that uses units of consumption, e.g., telephone charges, rather than currency. (JDH)

13804 (CONF-8704175—, pp 150-155) **The present status and future prospects of IC cards in Japan.** Seki, Ikuo. (Toppan Printing Co., Tokyo, Japan). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This paper describes the use of IC cards in Japan. A major part of the paper deals with the manufacturing and inspection of the cards. 4 figs., 2 tabs. (JDH)

13805 (CONF-8704175—, pp 156-163) **Physical certificates essential for stocks and bonds.** Parker, D.B. (SRI International, Menlo Park, CA). 1987. NTIS, PC A08/MF A01. Order Number DE88002540/JAW.

From International conference on security documents for the 21st century; San Diego, CA, USA (1 Apr 1987).

This report discusses the value and security of physical certificates and their replacement by computer book-entry records for individual owners. It contends that computer technology, operators of computer systems, and supportive functions including issuing, brokerage, regulations, and law are probably not yet sufficiently advanced to make computer book entry as safe as current procedures. Although the information-security functions of deterrence, prevention, and detection of loss, combined with recovery from loss and correction of vulnerabilities, reduce the risk of using computers for most applications, these applications involve short retention cycles, and results are frequently checked for timely and straightforward resolution of relatively small discrepancies. However, a few applications, such as book entry of stocks and bonds to record legal ownership of individuals' assets, should be approached with caution. The long retention cycle and infrequency of transaction settlements and clearing for comparatively large asset values would put new intractable demands on the security of today's computers. Therefore, physical certificates should continue to be made available, and individual owners of stocks and bonds should be encouraged to obtain them until the safety of new methods is assured.

13806 **(DOE/MA—0299/3) Department of Energy audit resolution, followup and internal control review activity: Quarterly management report as of September 30, 1987.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Audit Liaison Div.). Dec 1987. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004266/JAW.

This report provides information to the Department of Energy (DOE) management on the status of audit followup, General Accounting Office (GAO), Inspector General (IG) and internal control review activity for the quarter ended September 30, 1987.

13807 **(ORNL/TM—10558) Analysis of tasks for dynamic man/machine load balancing in advanced helicopters.** Jorgensen, C.C. (Oak Ridge National Lab., TN (USA)). Oct 1987. Contract AC05-84OR21400. 33p. (CESAR—87/44). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003735/JAW.

This report considers task allocation requirements imposed by advanced helicopter designs incorporating mixes of human pilots and intelligent machines. Specifically, it develops an analogy between load balancing using distributed non-homogeneous multiprocessors and human team functions. A taxonomy is presented which can be used to identify task combinations likely to cause overload for dynamic scheduling and process allocation mechanisms. Designer criteria are given for function decomposition, separation of control from data, and communication handling for dynamic tasks. Possible effects of n-p complete scheduling problems are noted and a class of combinatorial optimization methods are examined.

13808 **(SAND—87-2801C) Innovation and creativity: A critical linkage.** Hueter, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 7p. (CONF-880234—1). NTIS, PC A02. Order Number DE88003309/JAW.

From College industry education conference; San Diego, CA, USA (8 Feb 1988).

Creativity involves the associating of hitherto unrelated elements to form a new and useful combination. All have the ability but most seldom use it because of some false beliefs and failure to understand the creative process. Deterrents to creativity include fear of criticism, narrowness of education and training, habit, negative attitudes toward problems, lack of motivation, lack of self-confidence, lack of courage and discouragement by failures. The recognition and development of creative ideas requires mental effort, an open mind, searching seemingly unrelated fields and definition of the problem. Brainstorming is widely used to produce alternate ideas. Modifications of it are the Gordon Technique and Synectics. Morphological analysis and the examination of attributes are other aids to creativity. Recognition of a need, or of a new use of an old idea can be helpful. Management should encourage attempts at creativity. If the will exists, creativity can be developed by conscious effort instead of being left to chance.

13809 **(WHC-EP—0095) Basic Instructor Training Course.** Morgan, M.P. (Westinghouse Hanford Co., Richland, WA (USA)). [1987]. Contract AC06-87RL10930. 153p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88003373/JAW.

Originally, the program intent was to establish foundation for instructors in the UNC Training Department to become certified in accordance to nuclear industry-accepted standards. However, personnel from other organizations, along with DOE representatives and United States government contractors, have utilized the program as a learning base for planning, developing, and implementing instructional presentations. The course content presents a wide variety of material relative to learning behaviors, educational theory, and instructional methodology. The content is presented on a team-teaching basis with usually three or more different instructors. This provides students opportunity to observe a variety of instructional styles, mannerisms, and personalities, lending interest and student introspection.

9901 Management

REFER ALSO TO CITATION(S) 11539, 11540

13810 **(DOE/IG—0246) Sole-source procurements by E.I. Du Pont de Nemours and Company for the Department of Energy's Savannah River Plant.** (USDOE Office of Inspector General, Oak Ridge, TN. Eastern Regional Office). 2 Dec 1987. 31p. OSTI, PO Bx 62, Oak Ridge, TN 37831. Order Number TI88004359/JAW.

Report to The Secretary.

We reviewed Du Pont's material requirement determinations and procurement policies, procedures, and practices. We also reviewed the extent of supervision SR provided the contractor's procurement activities and the contractor's responsiveness in correcting problems identified by SR. Noncompetitive (single or sole-source) procurements and selected competitive procurements awarded during the period July 1, 1985 to June 30, 1986, were examined. Subsequent transactions were reviewed when necessary to meet audit objectives. The field work was conducted between July 21, 1986, and February 28, 1987.

13811 **(PAEC(A)IV-A—86012) Annual report 1986.** (Philippine Atomic Energy Commission, Diliman, Quezon City). 1986. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number TI88701211/JAW.

The report covers all the research and development activities on the application of nuclear energy in agriculture and natural resources, health and nutrition, industry and energy, basic science and emerging techologies. It also reports nuclear services rendered as well as nuclear technology and engineering services, nuclear regulations licensing and safeguards; emergency preparedness and environmental safety; and scientific and technological services and information. (ELC).

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 12268

13812 **(AD-A—184807/6/XAB) Computer modeling of complete IC fabrication process. Final report, 1 October 1983-1 February 1987.** Dutton, R.W. (Stanford Univ., CA (USA)). 28 May 1987. 34p. NTIS, PC A03/MF A01.

The focus of this research effort is the development of fundamental algorithms for process and device modeling as well as novel integration of the tools for advanced IC technology design. The development of the first complete 2D process simulator, SUPREM 4, is reported. The algorithms are discussed as well as application to local-oxidation and extrinsic diffusion conditions occur in CMOS AND BiCMOS technologies. The evolution of 1D (SEDAN) and 2D (PISCES) device analysis is discussed. The application of SEDAN to a variety of non-silicon technologies (GaAs and HgCdTe) are considered. A new multi-window analysis capability for PISCES which exploits Monte Carlo analysis of hot carriers was demonstrated and used to characterize a variety of silicon MOSFET and GaAs MESFET effects. A parallel computer implementation of PISCES was achieved using a Hypercube architecture. The PISCES program was used for a range of important device studies including: latchup, analog switch analysis, MOSFEt capacitance studies and bipolar transient device for ECL gates. The program is broadly applicable to RAM and BiCMOS technology analysis and design. In the analog-switch-technology area this research effort has produced a variety of important modeling and advances.

13813 **(AD-A—185108/8/XAB) Implementation of level-index arithmetic using partial table look-up.** Olver, F.W.; Turner, P.R. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). 1987. 5p. NTIS, PC A02/MF A01.

This paper is concerned with finding fast efficient algorithms for performing level-index arithmetic. The approach used combines the advantages of parallel processing with the use of table look-up. The latter is used only for short words and the result is a potential

implementation with level-index operation times comparable with floating-point long multiplications.

13814 **(ANL/MCS-TM—100) An adaptive pseudo-spectral method for reaction diffusion problems.** Bayliss, A.; Gottlieb, D.; Matkowsky, B.J.; Minkoff, M. (Argonne National Lab., IL (USA)). Oct 1987. Contract W-31109-ENG-38. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004718/JAW.

We consider the spectral interpolation error for both Chebyshev pseudo-spectral and Galerkin approximations. We develop a family of functionals I/sub r/(u), with the property that the maximum norm of the error is bounded by I/sub r/(u)/J/sup r/, where r is an integer and J is the degree of the polynomial approximation. These functionals are used in an adaptive procedure whereby the problem is dynamically transformed to minimize I/sub r/(u). The number of collocation points is then chosen to maintain a prescribed error bound. The method is illustrated by various examples from combustion problems in one and two dimensions. 13 refs., 9 figs.

13815 **(ANL/MCS-TM—101) A multigrid preconditioner applied to a two-dimensional convection-diffusion problem.** Jordan, K.E.; Bayliss, A. (Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004765/JAW.

We consider a preconditioner for convective diffusion problems based on a small number of sweeps of a multi-grid applied only to the diffusion part of the operator. The preconditioner is applied to the normal equations, and the conjugate gradient method is used as the iteration scheme. This extends a preconditioner which has been shown to be effective for Helmholtz type equations. The numerical experiments indicate that best convergence is obtained using only a small number of sweeps of the multi-grid algorithm and that this preconditioner may be more effective than a fast solver for the diffusion part of the operator. 8 refs., 1 fig., 4 tabs.

13816 **(BDX—613-3734) HERB: A production system for programming with hierarchical expert rule bases: User's manual, HERB Version 1.0.** Hummel, K.E. (Allied-Signal, Inc., Kansas City, MO (USA). Bendix Kansas City Div.). Dec 1987. Contract AC04-76DP00613. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88004367/JAW.

Expert systems are artificial intelligence programs that solve problems requiring large amounts of heuristic knowledge, based on years of experience and tradition. Production systems are domain-independent tools that support the development of rule-based expert systems. This document describes a general purpose production system known as HERB. This system was developed to support the programming of expert systems using hierarchically structured rule bases. HERB encourages the partitioning of rules into multiple rule bases and supports the use of multiple conflict resolution strategies. Multiple rule bases can also be placed on a system stack and simultaneously searched during each interpreter cycle. Both backward and forward chaining rules are supported by HERB. The condition portion of each rule can contain both patterns, which are matched with facts in a data base, and LISP expressions, which are explicitly evaluated in the LISP environment. Properties of objects can also be stored in the HERB data base and referenced within the scope of each rule. This document serves both as an introduction to the principles of LISP-based production systems and as a user's manual for the HERB system. 6 refs., 17 figs.

13817 **(CONF-8707110—3) Probabilistic neural networks: In or out of equilibrium?.** Clark, J.W. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002907/JAW.

From 11. international workshop on condensed matter theories; Oulu, Finland (27 Jul 1987).

The long-term behavior of neural networks following exposure to external stimuli is central to attempts at modeling brain activity and to the design of physical systems imitating biological mechanisms of memory storage and recall. A given network may exhibit many attractors, while a given attractor may correspond to a fixed point, a terminal cycle, multiperiodic motion, or chaos. If the dynamical law by which the system updates its state is probabilistic rather than deterministic, one considers an ensemble rather than a particular system. The initial preparation of the system attendant to the imposition of a temporary stimulus is reflected in the specification of an initial probability distribution (p/sub i/(0)) over microscopic system states i. Here an especially simple class of probabilistic neural network models is considered, simple in the senses that the large-t occupation probabilities are steady, implying a fixed-point attractor, and this final condition is unique, i.e. independent of initial preparation, for specified single-neuron properties and interneuronic couplings. 17 refs.

13818 **(DOE/ER/25001—33) Cedar Fortran programmer's manual: Cedar Project.** Guzzi, M.D. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 22 Jun 1987. Contract FG02-85ER25001. 48p. (CSRD—601). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003586/JAW.

This document describes the extensions that Cedar Fortran adds to Fortran 77. These extensions are classified in three groups: specification statement extensions, vectorization and concurrency, and task initiation and synchronization. 12 refs.

13819 **(DOE/ER/25001—36) The performance of software-managed multiprocessor caches on parallel numerical programs.** Hoichi Cheong; Veidenbaum, A.V. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 22p. (CONF-8706183—3). NTIS, PC A03. Order Number DE88003590/JAW.

From ICS '87: international conference on supercomputing; Athens, Greece (8 Jun 1987).

In recent years interest has grown in multiprocessor architectures that can have several hundred processors sharing memory and all working on solving a single problem. Such multiprocessors are characterized by a long memory access time, which makes use of cache memories very important. However, the cache coherence problem makes the use of private caches difficult. The proposed solutions to the cache coherence problem are not suitable for a large-scale multiprocessor. We proposed a different solution that relies on a compiler to manage the caches during the execution of a parallel program. In this paper we discuss the performance evaluation of private cache memories for multiprocessors in general and present the results of performance improvement for parallel numerical programs using the caches managed with compiler assistance. The effect of cache organization and other system parameters such as cache block size, cache size, and the number of processors in the system performance is shown. 18 refs., 2 figs., 7 tabs.

13820 **(DOE/ER/25001—37) Debugging Fortran on a shared memory machine.** Allen, T.R.; Padua, D.A. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 8p. (CONF-870831—6). NTIS, PC A02. Order Number DE88003589/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Debugging on a parallel processor is more difficult than debugging on a serial machine because errors in a parallel program may introduce nondeterminism. The approach to parallel debugging presented here attempts to reduce the problem of debugging on a parallel machine to that of debugging on a serial machine by automatically detecting nondeterminism. 20 refs., 6 figs.

13821 **(DOE/ER/25001—38) The impact of hierarchical memory systems on linear algebra algorithm design.** Gallivan, K.; Jalby, W.; Meier, U.; Sameh, A. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 14 Sep 1987. Contract FG02-85ER25001. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003574/JAW.

Performing an extremely detailed performance optimization analysis is counterproductive when the concern is performance behavior on a class of architecture, since general trends are obscured by the overwhelming number of machine-specific considerations required. Instead, in this paper, a methodology is used which identifies the effects of a hierarchical memory system on the performance of linear algebra algorithms on multivector processors; provides a means of producing a set of algorithm parameters, i.e., blocksizes, as functions of system parameters which yield near-optimal performance; and provides guidelines for algorithm designers which reduce the influence of the hierarchical memory system on algorithm performance to negligible levels and thereby allow them to concentrate on machine-specific optimizations. The remainder of this paper comprises five major discussions. First, the methodology and the attendant architectural model are discussed. Next, an analysis of the basic BLAS3 matrix-matrix primitive is presented. This is followed by a discussion of three block algorithms: a block LU decomposition, a block LDL/sup T/ decomposition and a block Gram-Schmidt algorithm. 22 refs., 9 figs.

13822 **(DOE/ER/25001—39) Deadlock prevention in processor self-scheduling for parallel nested loops.** Tang, Peiyi; Yew, Pen-Chung; Fang, Zhixi; Zhu, Chuan-Qi. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development; Wichita State Univ., KS (USA). Dept. of Computer Science). Jan 1987. Contract FG02-85ER25001. 39p. (CONF-870831—5; CSRD—626). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003573/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Processor self-scheduling is an effective distributed dynamic scheduling scheme for parallel nested loops in multiprocessor systems. A parallel nested loop structure can be considered as a task system. A task is an interation (or several iterations) of an innermost loop body and the execution order of tasks is determined by a precedence relation. Data dependences among statements are enforced either by the precedence relation or by explicit synchronization. Since self-scheduling is non-preemptive and uses busy-waiting as the basic technique for task synchronization, deadlocks may possibly arise. This paper identifies conditions that allow deadlock-free processor self-scheduling. It uses control tokens and data tokens to model the precedence relation and data dependences. Both control tokens and data tokens, together with processors, are regarded as three kinds of resources needed by tasks. Based on this resource model, we study three possible self-scheduling schemes with different degrees of parallelism, and propose to use appropriate scheduling priority for allocating processors to prevent deadlocks. 12 refs., 7 figs.

13823 **(DOE/ER/25001—40) Run-time analysis for loops containing procedure calls.** Li, Zhiyuan; Yew, Pen-Chung. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 20 Jan 1987. Contract FG02-85ER25001. 25p. (CONF-870831—13). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003575/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Loops containing procedure calls are usually very difficult to analyze at compile time. This often causes loops to be executed serially because the information needed for analysis is not available at compile time. Currently, procedure calls are either expanded in line, or are analyzed using very complicated data flow analysis. In this paper, we propose a run-time for loops containing procedure calls. It is done by checking cross-iteration dependences in those loops. Using efficient synchronization primitives, the test can be performed quite efficiently at run time. It provides a viable alternative when compile time analysis fails. 23 refs., 7 figs.

13824 **(DOE/ER/25001—42) Multiprocessor cache design considerations.** Lee, R.L.; Yew, Pen-Chung; Lawrie, D.H. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 10p. (CONF-8706138—1). Association for Computing Machinery, 11 W. 42nd St., New York, NY 10036. Order Number TI88003587/JAW.

From 14. annual international symposium on computer architecture; Pittsburgh, PA, USA (2 Jun 1987).

In this paper, cache design is explored for large high-performance multiprocessors with hundreds or thousands of processors and memory modules interconnected by a pipelined multi-stage network. The majority of the multiprocessor cache studies in the literature exclusively focus on the issue of cache coherence enforcement. However, there are other characteristics unique to such multiprocessors which create an environment for cache performance that is very different from that of many uniprocessors. Multiprocessor conditions are identified and modeled, including: the cost of a cache coherence enforcement scheme, the effect of a high degree of overlap between cache miss services, the cost of a pin limited data path between shared memory and caches, the effect of a high degree of data prefetching, the program behavior of a scientific workload as represented by 23 numerical subroutines, and the parallel execution of programs. This model is used to show that the cache miss ratio is not a suitable performance measure in the multiprocessors of interest and to show that the optimal cache block size in such multiprocessors is much smaller than in many uniprocessors. 31 refs., 10 figs., 1 tab.

13825 **(DOE/ER/25001—43) Using program structure to achieve prefetching for cache memories.** Brent, G.A. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jan 1987. Contract FG02-85ER25001. 179p. (UILU-ENG—87-8001; CSRD—647). NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003599/JAW.

A concise program structure notation, called a program skeleton, is developed that can be used for program analysis or, if machine-specific details are included, for memory prefetching. The program skeleton describes the structure of the source code as well as the low-level accessing behavior. Transformations are developed to create a machine-specific cache memory prefetching control program, called the prefetch skeleton (PFS), from the program skeleton. A prefetching unit (PFU) is developed as a simple in-cache processor. The PFU executes the PFS and generates cache line prefetch requests ahead of CPU demand requests. A variety of PFS-cache machines are simulated in detail to demonstrate the feasibility of the PFS prefetcher. Instruction miss delays can be reduced significantly by using a PFS-cache. Some reduction in data miss delays is also obtained even though the PFS as developed in this initial research focuses primarily on instruction prefetching. The PFS prefetching scheme improves cache performance without requiring programmer involvement, since the PFS is generated automatically by the compiler as it compiles the source program. The PFS concept is compatible with a variety of programming languages. The PFS-cache machine is capable of running non-PFS programs, although better performance is obtained when the programs are recompiled to create the PFS. 8 refs., 28 figs., 22 tabs.

13826 **(DOE/ER/25001—44) Using memory in the Cedar system.** McGrath, R.E.; Emrath, P. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 30p. (CONF-8706183—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003597/JAW.

From ICS '87: international conference on supercomputing; Athens, Greece (8 Jun 1987).

The design of the virtual memory system for the Cedar multiprocessor under construction at the University of Illinois is discussed. The Cedar architecture features a hierarchy of memory, some shared by all processors, and some shared by subsets of processors. The Xylem operating system is based on Alliant Computer Systems CONCENTRIX(TM) operating system, which is based on 4.2BSD UNIX(TM). Xylem supports multi-tasking and demand paging of parts of the memory hierarchy into a linear virtual address space. Memory may be private to a task or shared between all the tasks. The locality and attributes of a page may be modified during the execution of a program. Examples of how these mechanisms can be used are discussed. 14 figs.

13827 (DOE/ER/25001—45) Nonpreemptive run-time scheduling issues on a multitasked, multiprogrammed multiprocessor with dependencies, bidimensional tasks, folding and dynamic graphs. Miller, A.R. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). May 1987. Contract FG02-85ER25001. 113p. (UILU-ENG—87-8002; CSRD—656). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88003598/JAW.

Increases in high speed hardware have mandated studies in software techniques to exploit the parallel capabilities. This thesis examines the effects a run-time scheduler has on a multiprocessor. The model consists of directed, acyclic graphs, generated from serial FORTRAN benchmark programs by the parallel compiler Parafrase. A multitasked, multiprogrammed environment is created. Dependencies are generated by the compiler. Tasks are bidimensional, i.e., they may specify both time and processor requests. Processor requests may be folded into execution time by the scheduler. The graphs may arrive at arbitrary time intervals. The general case is NP-hard, thus, a variety of heuristics are examined by a simulator. Multiprogramming demonstrates a greater need for a run-time scheduler than does monoprogramming for a variety of reasons, e.g., greater stress on the processors, a larger number of independent control paths, more variety in the task parameters, etc. The dynamic critical path series of algorithms perform well. Dynamic critical volume did not add much. Unfortunately, dynamic critical path maximizes turnaround time as well as throughput. Two schedulers are presented which balance throughput and turnaround time. The first requires classification of jobs by type; the second requires selection of a ratio value which is dependent upon system parameters. 45 refs., 19 figs., 20 tabs.

13828 (DOE/ER/25001—47) A parallel block cyclic reduction algorithm for the fast solution of elliptic equations. Gallopoulos, E.; Saad, Y. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Apr 1987. Contract FG02-85ER25001. 16p. (CONF-8706183—4; CSRD—659). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003595/JAW.

From ICS '87: international conference on supercomputing; Athens, Greece (8 Jun 1987).

This paper presents an adaptation of the Block Cyclic Reduction (BCR) algorithm for a multi-vector processor. The main bottleneck of BCR lies in the solution of linear systems whose coefficient matrix is the product of tridiagonal matrices. This bottleneck is handled by expressing the rational function corresponding to the inverse of this product as a sum of elementary fractions. As a result the solution of this system leads to parallel solutions of tridiagonal systems. Numerical experiments performed on an Alliant FX/8 are reported. 11 refs., 1 tab.

13829 (DOE/ER/25001—49) The effectiveness of caches and data prefetch buffers in large-scale shared memory multiprocessors. Lee, R.L. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). May 1987. Contract FG02-85ER25001. 147p. (UILU-ENG—87-8005; CSRD—670). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003594/JAW.

Large shared memory multiprocessors usually have difficulty in matching the memory speed with the processor speed due to the large interconnection network between processors and shared memory. In this thesis, we explore the effectiveness of caches and data prefetching by the processor in eliminating the memory access bottleneck. Using trace driven simulations of numerical subroutines that have been transformed into parallel form, we model the following multiprocessor characteristics in our performance evaluation, the cost of a cache coherence enforcement scheme, the effect of a high degree of overlap between cache miss service, the cost of a pin limited data path between shared memory and caches, the effect of a high degree of data prefetching, the program behavior of a scientific workload as represented by over 20 numerical subroutines, and the parallel execution of programs. The optimal cache block size is examined in detail and we found that a small cache block size is favored in the multiprocessors of interest. A compile-time cache coherence scheme that allows data to change cacheability is proposed and is shown to significantly perform better than schemes which do not allow cacheability changes. We show the relative effectiveness of caches and data prefetching for a range of network delays and bandwidths and propose techniques to overcome some of the performance degradations due to read/write access to shared memory. 47 refs., 40 figs., 8 tabs.

13830 (DOE/ER/25001—50) Acceleration techniques for decoupling algorithms in semiconductor simulation. Kerkhoven, T.; Saad, Y. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1987. Contract FG02-85ER25001. 20p. (CSRD—686). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003593/JAW.

We propose three techniques for accelerating the nonlinear block Gauss-Seidel algorithm for steady state semiconductor simulation: a second order stationary method, a Chebyshev acceleration and a nonlinear version of the generalized minimal residual algorithm (GMRES.) The parameters for the second order stationary method and the Chebyshev acceleration are obtained from the spectrum of the derivative of the fixed point mapping T defining the nonlinear algorithm. This spectrum is approximated by a matrix-free Arnoldi technique. The numerical results reported agree well with theoretical predictions. In particular, the nonlinear version of GMRES is found to be considerably more effective in accelerating the nonlinear map than the two second order recurrences. 36 refs., 3 figs., 1 tab.

13831 (DOE/ER/25001—51) A parallel quasi-Newton method for partially separable large scale minimization. Chen, M.Q.; Han, S.P. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development; Illinois Univ., Urbana (USA). Dept. of Mathematics). Apr 1987. Contract FG02-85ER25001. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003592/JAW.

The parallel quasi-Newton method based on updating conjugate subspaces can be very effective for large-scale sparse minimization because conjugate subspaces with respect to sparse Hessians are usually easy to obtain. We demonstrate this point in this paper for the partially separable case with matrices updated by a quasi-Newton scheme of Griewank and Toint. The algorithm presented is suitable for parallel computation and economical in computer storage. Some testing results of the algorithm on an Alliant FX/8 mini-supercomputer are reported. 5 refs.

13832 (DOE/ER/25001—61) The Λ network: A new permutation network. Lee, D. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 5p. (CONF-870831—10). NTIS, PC A02. Order Number DE88003568/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

A new permutation network, called the Λ network is presented. The Λ network which is based on the Batcher sorter, passes arbitrary permutation under a local single bit control. The network is highly modular, and suitable for a pipelined, packet-switching operation. Our construction of the Λ network illustrates an approach by which a permutation network can be obtained from a sorting network. Also the basic idea of deriving a new multistage interconnection network from a permutation network is discussed, together with some aspects of the applications of the Λ network as an interconnection network for a parallel supercomputer. 5 refs., 5 figs.

13833 (DOE/ER/25001—62) An enhancement scheme for hypercube interconnection networks. Hsu, William Tsun-yuk; Yew, Pen-Chung; Zhu, Chuan-Qi. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jan 1987. Contract FG02-85ER25001. 35p. (CONF-870831—9). Univ. of Illinois at Urbana-Champaign, 104 S. Wright St., Urbana, IL 61801. Order Number TI88003569/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Hypercube interconnection networks have been used in many commercially available multiprocessor systems like the Cosmic Cube, Intel iPSC, N-Cube, and Connection Machine. It was found that the hypercube does not use its extra hardware very

efficiently. A new interconnection structure is proposed as an alternative to the hypercube. This new network has a better performance while using less hardware. Since it uses similar types of hardware as the hypercube, it is relatively easy to adapt existing hypercube multiprocessors to the new network for better performance. 14 refs., 10 figs., 1 tab.

13834 **(DOE/ER/25001—63) Parallel access to synchronization variables.** Jayasimha, D.N. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jan 1987. Contract FG02-85ER25001. 11p. (CONF-870831—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003570/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

The following synchronization problem occurs in parallel processing: a set of n processes need to begin execution of their next tasks only after every process has completed its current task. Such a barrier synchronization is usually implemented by shared variable(s) in a tightly coupled multiprocessor. We define the completion time as the earliest time when every process knows that all other processes have completed. We develop analytical models using Markov chains to estimate the effects of barrier synchronization on the completion time of processes. Three algorithms are given to implement barrier synchronization and completion time expressions are derived for these implementations. The relative merits of the three schemes are compared. Two schemes require O(nlogn) accesses as opposed to 2n-1, the idealized number of accesses. The third scheme which is difficult to implement has a linear growth in the number of accesses (approx. 4n). 11 refs., 3 figs.

13835 **(DOE/ER/25001—64) Loop coalescing: A compiler transformation for parallel machines.** Polychronopoulos, C.D. (Illinois Univ., Urbana (USA)). 1987. Contract FG02-85ER25001. 8p. (CONF-870831—7). NTIS, PC A02. Order Number DE88003571/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

In this paper we discuss a compiler transformation called loop coalescing which can be used to reduce run-time overhead and simplify the loop scheduling problem. Parallel loops account for the greatest amount of parallelism in numerical programs. Executing nested loops in parallel with low run-time overhead is thus very important for achieving high performance on parallel computers. Loop coalescing is a restructuring technique that transforms several types of nested parallel loops into a single loop. As a result of this transformation the loop scheduling problem becomes simple. Moreover the amount of synchronization (i.e., run-time overhead) associated with the parallel execution of loops is reduced sharply through loop coalescing. Several examples are presented and the general transformation is discussed in detail. We also give an example of the application of loop coalescing to loop scheduling. 23 refs., 10 figs.

13836 **(DOE/ER/25001—65) Dynamic processor self-scheduling for general parallel nested loops.** Fang, Zhixi; Tang, Peiyi; Yew, Pen-Chung; Zhu, Chuan-Qi. (Wichita State Univ., KS (USA). Dept. of Computer Science; Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 10 Sep 1987. Contract FG02-85ER25001. 42p. (CONF-870831—14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003572/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

In this paper we present a completely dynamic processor self-scheduling approach for general nested loops. General nested loops contain both parallel and serial loops and the execution time of their iterations can vary widely. In our scheme, an instance of an innermost loop is considered to be a basic unit in a precedence graph. An instance is said to be active if the instance is ready to be executed. Completion of an instance will activate instance of other innermost loops. The basic concept in our scheme is to keep all processors busy as long as there exists any active instance. By effectively using synchronization primitive provided in a parallel processing system, the overhead of our approach can be significantly reduced. We also present the data structure needed to represent a general nested loop in our self-scheduling scheme. 19 refs., 8 figs.

13837 **(DOE/ER/25001—73) PSolve: A concurrent algorithm for solving sparse systems of linear equations.** Davis, T.A.; Davidson, E.S. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 8p. (CONF-870831—11). NTIS, PC A02. Order Number DE88003584/JAW.

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

PSolve solves a sparse system of linear equations on a shared-memory parallel processor. Each autonomous process reduces a pair of matrix rows, uses pairwise pivoting for numerical stability, and synchronizes with only a few others at a time. For most test matrices, on the Alliant FX/8 multiprocessor, PSolve is faster than Gaussian Elimination (does not exploit sparsity) and the Yale Sparse Matrix Package (does not exploit parallelism). Although Gaussian Elimination runs in vector mode, PSolve cannot use currently available vector hardware because of its compact matrix storage scheme. However, with a new "sparse-align" vector unit, PSolve is vectorizable and runs faster than any other algorithm for all the selected test matrices. 11 refs., 10 figs.

13838 **(DOE/ER/25001—80) A direct parallelization of call statements: A review.** Banerjee, U. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Apr 1986. Contract FG02-85ER25001. 20p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003525/JAW.

This paper gives a brief review on the problem of handling call statements in a multiprocessor environment. The approach is to try first the direct parallelization of each call, and then expansion only if needed. Direct parallelization of a call statement means treating the call as a single entity that is represented by a single node on the dependence graph. It requires a careful analysis of the effects of procedures and translation of the knowledge about a called procedure into information on variables of the calling procedure; a general dependence testing method is also needed. We describe direct parallelization, compare it with expansion, and compare this dependence test with the dependence tests currently in use. 14 refs.

13839 **(DOE/ER/25001—81) Automatic generation of synchronization instructions for parallel processors.** Midkiff, S.P. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). May 1986. Contract FG02-85ER25001. 97p. (UILU-ENG—86-8002). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003603/JAW.

The development of high speed parallel multi-processors, capable of parallel execution of doacross and forall loops, has stimulated the development of compilers to transform serial FORTRAN programs to parallel forms. One of the duties of such a compiler must be to place synchronization instructions in the parallel version of the program to insure the legal execution order of doacross and forall loops. This thesis gives strategies usable by a compiler to generate these synchronization instructions. It presents algorithms for reducing the parallelism in FORTRAN programs to match a target architecture, recovering some of the parallelism so discarded, and reducing the number of synchronization instructions that must be added to a FORTRAN program, as well as basic strategies for placing synchronization instructions. These algorithms are developed for two synchronization instruction sets. 20 refs., 56 figs.

13840 **(DOE/ER/25001—82) Some issues in general-purpose shared memory multiprocessing: Parallelism exploitation and memory access combining.** Lee, Gyungho. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jun 1986. Contract FG02-85ER25001. 130p. (UILU-ENG—86-8003). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003602/JAW.

The use of automatic program restructuring and memory access combining for "general-purpose" large scale shared memory machine is investigated. The effects of unpredictable control flows and data accesses on the effectiveness of automatic program restructuring are considered through the experiments of several basic nonnumerical programs. Various loop structures found are classi-

fied, and their effects are investigated. Also, the importance of algorithm change is considered. In addition, a way of parallelizing loops with conditional branching is studied. Several schemes of memory access combining are investigated. Inherent limit in the idea of memory access combining is revealed, and the effectiveness of those schemes is studied. An approximate formula to provide bounds on the best possible performance of memory access combining is developed, and a practical scheme to achieve performance close to such bounds in modest sized machines is proposed. 78 refs., 28 figs. 9 tabs.

13841 **(DOE/ER/25001—83) Solution of nonsymmetric systems of equations on a multiprocessor.** Kamath, C. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1986. Contract FG02-85ER25001. 186p. (UILU-ENG—86-8004; CSRD—591). NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88003580/JAW.

We consider the iterative solution of large sparse linear systems of equations arising from elliptic and parabolic partial differential equations in two and three space dimensions. Specifically, we focus our attention on non-symmetric systems of equations whose eigenvalues lie on both sides of the imaginary axis, or whose symmetric part is not positive definite. This system of equations is solved using the projection methods with conjugate gradient acceleration. The algorithm has been designed with special emphasis on its suitability for multiprocessors. In the first part of the thesis, we study the numerical properties of the algorithm and compare its performance with other algorithms such as the conjugate gradient method on the normal equations, the Chebyshev method, Orthomin(k), GCR(k) and GMRES(k). We also study the effect of various preconditioners on these methods. In the second part of the thesis, we implement our algorithm on the CRAY X-MP/48 multiprocessor and study its behavior as the number of processors is increased. 96 refs., 19 figs., 14 tabs.

13842 **(DOE/ER/25001—84) Fault-tolerant multiprocessor interconnection networks and their fault-diagnoses.** Tzeng, Nian-Feng. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1986. Contract FG02-85ER25001. 137p. (UILU-ENG—86-8005; CSRD—594). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88003601/JAW.

Interconnection networks have long been recognized as one of the key issues in designing a multiprocessor. A new scheme to provide multistage interconnection networks with fault-tolerant is introduced. Multiple paths between any input/output pair are created by connecting switching elements in the same stage together. The fault-tolerant interconnection network is investigated in both its reliability and its performance. Because the maximum number of possible alternative paths inherent in a network is exploited, the proposed fault-tolerant network possesses long mean lifetime and demonstrates high bandwidth. This scheme can be applied to notably enhance reliability and performance of any known multistage interconnection networks. To diagnose a fault in a redundant-path interconnection network is far more involved than in a regular one. Based on a novel fault-model, a diagnostic procedure is developed to effectively detect and locate any single fault existing in the Multiple-path network. The fault-model, a diagnostic procedure is developed to effectively detect and locate any single fault existing in the multiple-path network. The fault-model is practical and has potential usefulness as a tool for modeling faulty states of larger switching elements (e.g., n x n switching elements with $n > 2$). To facilitate this procedure, faults are classified into two groups in each of which the necessary test vectors are provided for correctly setting switching elements in the network under diagnosis when the procedure is conducted. 55 refs., 44 figs., 8 tabs.

13843 **(DOE/ER/25001—85) On program restructuring, scheduling, and communication for parallel processor systems.** Polychronopoulos, C.D. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1986. Contract FG02-85ER25001. 266p. (CSRD—595; UILU-ENG—86-8006). NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88003532/JAW.

This dissertation discusses several software and hardware aspects of program execution on large-scale, high-performance parallel processor systems. The issues covered are program restructuring, partitioning, scheduling and interprocessor communication, synchronization, and hardware design issues of specialized units. All this work was performed focusing on a single goal: to maximize program speedup, or equivalently, to minimize parallel execution time. Parafrase, a Fortran restructuring compiler was used to transform programs in a parallel form and conduct experiments. Two new program restructuring techniques are presented, loop coalescing and subscript blocking. Compile-time and run-time scheduling schemes are covered extensively. Depending on the program construct, these algorithms generate optimal or near-optimal schedules. For the case of arbitrarily nested hybrid loops, two optimal scheduling algorithms for dynamic and static scheduling are presented. Simulation results are given for a new dynamic scheduling algorithm. The performance of this algorithm is compared to that of self-scheduling. Techniques for program partitioning and minimization of interprocessor communication for idealized program models and for real Fortran programs are also discussed. The close relationship between scheduling, interprocessor communication, and synchronization becomes apparent at several points in this work. Finally, the impact of various types of overhead on program speedup and experimental results are presented. 69 refs., 74 figs., 14 tabs.

13844 **(DOE/ER/25001—86) The structured memory access architecture: An implementation and performance-evaluation.** Cyr, J.B. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1986. Contract FG02-85ER25001. 79p. (UILU-ENG—86-8008). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003527/JAW.

The Structured Memory Access (SMS) architecture implementation presented in this thesis is formulated with the intention of alleviating two well-known inefficiencies that exist in current scalar computer architectures: address generation overhead and memory bandwidth utilization. Furthermore, the SMA architecture introduces an additional level of parallelism which is not present in current pipelined supercomputers, namely, overlapped execution of the access process and execute process on two distinct special-purpose, asynchronously-coupled processors. Each processor executes a separate instruction stream to perform its specific task which, together, are functionally equivalent in a conventional program. Our simulation results show that, for typical numerical programs, the access processor (MAP) is capable of achieving slip, i.e., running sufficiently ahead of the execute processor (CP) so that operand fetch requests for data items required by the CP are issued early enough and rapidly enough for the CP rarely to experience any memory access wait time. In this manner the SMA tolerates long memory access time, albeit high bandwidth, paths to memory without sacrificing performance. Speedups relative to the Cray-1 in scalar mode often exceed two, due to dual processing and reductions in memory wait time. 17 refs., 11 figs., 3 tabs.

13845 **(DOE/ER/25001—87) Multitasking runtime systems for the Cedar Multiprocessor.** Guzzi, M.D. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jul 1986. Contract FG02-85ER25001. 73p. (UILU-ENG—86-8009). NTIS, PC A04/MF A01; GPO Dep. Order Number DE88003528/JAW.

The programming of a MIMD machine is more complex than for SISD and SIMD machines. The multiple computational resources of the machine must be made available to the programming language compiler and to the programmer so that multitasking programs may be written. This thesis will explore the additional complexity of programming a MIMD machine, the Cedar Multiprocessor specifically, and the multitasking runtime system necessary to provide multitasking resources to the user. First, the problem will be well defined: the Cedar machine, its operating system, the programming language, and multitasking concepts will be described. Second, a solution to the problem, called macrotasking, will be proposed. This solution provides multitasking facilities to the programmer at a very coarse level with many visible machine dependencies. Third, an alternate solution, called microtasking, will be proposed. This solution provides multitasking facilities of a much finer grain. This solution does not depend so rigidly on the specific architecture of the machine. Finally, the two solutions will be compared for effectiveness. 12 refs., 16 figs.

13846 **(DOE/ER/25001—88) The behaviour of conjugate gradient based algorithms on a multi-vector processor with a memory hierarchy.** Jalby, W.; Meier, U.; Sameh, A. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 23 Nov 1986. Contract FG02-85ER25001. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88003529/JAW.

The conjugate gradient algorithm is one of the most efficient solvers for elliptic partial differential equations and has been successfully implemented on various vector computers. In this paper, the behaviour of conjugate gradient based algorithms on a multi-vector processor with a two-level memory hierarchy is investigated. Several domain decomposition techniques are considered as well as preconditioners that are suitable to be parallelized such as polynomial preconditioners or a vectorized version of the ICCG. Experimental results for the Poisson equation performed on an Alliant FX/8 are presented. 16 refs., 17 figs., 13 tabs.

13847 **(DOE/ER/25001—89) Fast and practical parallel polynomial interpolation.** Egecioglu, O.; Gallopoulos, E.; Koc, C.K. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jan 1987. Contract W-7405-ENG-48;FG02-85ER25001. 32p. (CSRD—646). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003530/JAW.

We present fast and practical parallel algorithms for the computation and evaluation of interpolating polynomials. The algorithms make use of fast parallel prefix techniques for the calculation of divided differences in the Newton representation of the interpolating polynomial. For $n + 1$ given input pairs the proposed interpolation algorithm requires $2\lceil \log (n + 1) \rceil + 2$ parallel arithmetic steps and circuit size $O(n^2)$. The algorithms are numerically stable and their floating-point implementation results in error accumulation similar to that of the widely used serial algorithms. This is in contrast to other fast serial and parallel interpolation algorithms which are subject to much larger roundoff. We demonstrate that in a distributed memory environment context, a cube connected system is very suitable for the algorithms' implementation, exhibiting very small communication cost. As further advantages we note that our techniques do not require equidistant points, preconditioning, or use of the Fast Fourier Transform. 21 refs., 4 figs.

13848 **(DOE/ER/25001—90) Parcel: Project for the Automatic Restructuring and Concurrent Evaluation of Lisp.** Harrison, W.L. III; Padua, D.A. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). 1987. Contract FG02-85ER25001. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003533/JAW.

Parcel (Project for the Automatic Restructuring and Concurrent Evaluation of Lisp) is an investigation of the problem of compiling Lisp for evaluation on a shared memory multiprocessor. In this paper, we present an overview of the process of compilation in Parcel. This process consists, broadly, of an interprocedural analysis, followed by the function-level restructuring of the lambda expressions composing a program. We discuss both of the phases, and illustrate the steps of restructuring with a few examples. A novel representation for s-expressions is employed in Parcel, to facilitate the parallel creation and access of lists; we review this representation, and discuss its implications for the compilation process. 14 refs., 8 figs.

13849 **(DOE/ER/25001—92) An Ethernet local area network controller with supporting operating system software.** Konigsfeld, K.G. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1987. Contract FG02-85ER25001. 93p. (CSRD—668; UILU-ENG—87-8004). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88003534/JAW.

Presented in this thesis is the design of an Ethernet local area network as applied to both a general purpose interface and an application specific network system. First, the design considerations for both hardware and software are analyzed. Next, the design of an IBM PC/AT Ethernet controller and interface is presented. The hardware is described as it relates specifically to the IBM PC/AT environment as well as a development system for a stand-alone processor and communication link. One application of this stand-alone processor is the Cedar diagnostic system which uses several remote processors linked together through an Ethernet network. In addition to being a development system, the IBM PC/AT controller is also a potential network manager for the diagnostic system. The design of the controller's low-level operating system is also described as an implementation of the issues of protocol control and processor management. The operating system executes within the confines of the stand-alone processor system and may also be applied to the Cedar diagnostic system as a flexible program executive. Finally, current development problems and future work are presented. 9 refs., 12 figs., 6 tabs.

13850 **(DOE/ER/25001—94) A measurement-based study of concurrency in a multiprocessor.** McGuire, P.J. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jan 1987. Contract FG02-85ER25001. 59p. (CSRD—674; UILU-ENG—87-2210). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88003536/JAW.

This thesis develops a systematic measurement-based methodology for characterizing the amount of concurrency present in a workload, and the effect of concurrency on systen performance indices such as cache miss rate and bus activity. Hardware and software instrumentation of an Alliant FX/8 at the University of Illinois Center for Supercomputing Research and Development was used to obtain data from a real workload environment. Results show that 35% of the workload is concurrent, with the concurrent periods typically using all available processors. Measurements of periods of change in concurrency show uneven usage of processors during these times. Other system measures, including cache miss rate and processor bus activity, are analyzed with respect to the concurrency measures. Probability of a coache miss is seen to increase with concurrency. The change in the cache miss is much more sensitive to the fraction of concurrent code in the workload than the number of processors active during concurrency. Regression models are developed to quantify the relationships between cache miss rate, bus activity and the concurrency measures. The model for cache miss rate predicts an increase in the median miss rate values of an much as 300% for a 100% increase in concurrency in the workload. 25 refs., 14 figs., 4 tabs.

13851 **(DOE/ER/25001—95) A performance analysis of architectural scalability.** Kwok, A.Y.W. (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1987. Contract FG02-85ER25001. 232p. (CSRD—679; UILU-ENG—86-8006). NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88003537/JAW.

The peak performance of a multiprocessor system is rarely attainable. Algorithm penalty, interprocessor communication cost, and synchronization overhead are major factors limiting the performance scalability. The MPPP is a trace driven simulation facility developed for the performance prediction of large scale multiple vector-processor systems. This facility, when used with the Parafrase program restructurer, provides a powerful tool for studying the performance of parallel Fortran programs under variations of architecture, system, and workload parameters. Using the MPPP facility, we analyze the performance scalability issue at three different levels: the algorithm restructuring level, the compiler optimization level, and the machine organization level. Johnsson's narrow banded linear systems solver, the fast Fourier transform, the preconditioned conjugate gradient method, and the Gaussian elimination with pivoting algorithm were used as sample workload in our analysis. 96 refs., 88 figs.

13852 **(DOE/ER/25001—T1) Center for Supercomputing Research and Development: Quarterly report, First quarter, 1987.** (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Jun 1987. Contract FG02-85ER25001. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003564/JAW.

This paper discusses progress on hardware and applications of superconducting design. The topic titles covered are: hardware development, architecture research, operating system research and development, Cedar Fortran, symbolic processing, compiler re-

search, scientific workstation environment, and numerical library. (LSP)

13853 **(DOE/ER/25001—T2) Center for Superconducting Research and Development: Quarterly report, Second quarter, 1987.** (Illinois Univ., Urbana (USA). Center for Supercomputing Research and Development). Aug 1987. Contract FG02-85ER25001. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003563/JAW.

This report summarizes the work done at the Center for Superconducting Research and Development in the following areas: hardware development, architecture research, operating system development, operating system research, Cedar Fortran, symbolic processing, compiler research, scientific workstation environment (FAUST), numerical library and applications. (LSP)

13854 **(DOE/ER/25009—449) Emerging supercomputer architectures.** Messina, P.C. (California Inst. of Tech., Pasadena (USA)). 1987. Contract FG03-85ER25009. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003539/JAW.

This paper will examine the current and near future trends for commercially available high-performance computers with architectures that differ from the mainstream "supercomputer" systems in use for the last few years. These emerging supercomputer architectures are just beginning to have an impact on the field of high performance computing. 7 refs., 1 tab.

13855 **(DOE/ER/25009—451) Features of a TeraFlop supercomputer.** Fox, G.C.; Frey, A. (California Inst. of Tech., Pasadena (USA)). Aug 1987. Contract FG03-85ER25009. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003540/JAW.

We consider architectural, application, and software issues for the coarse grain distributed and shared memory concurrent computers, currently typified by the hypercubes, transputer arrays, the RP3 and BBN Butterfly, and summarize some of the lessons learned from several years of study. Based on these considerations we discuss the possibility of building a supercomputer with a maximum configuration that could sustain performance in the range of 10^{12} floating point operations per second with a memory of order 10^{12} bytes. We show how lessons from the use of current machines indicate that good performance would be obtained on a wide range of scientific problems. We suggest how such a machine could be built in the next few years with current technology. 31 refs., 1 fig., 3 tabs.

13856 **(DOE/ER/25009—467) QCD [quantum chromodynamics] and neural nets on the hypercube.** Kolawa, A.; Apostolakis, J.; Baillie, C.F.; Ding, H.; Flower, J.; Fox, G.C.; Furmanski, W.; Otto, S. (California Inst. of Tech., Pasadena (USA); Los Alamos National Lab., NM (USA)). [1987]. Contract FG03-85ER25009. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003541/JAW.

We contrast the use of the hypercube concurrent computer on two different problem classes. The first is a regular Monte Carlo; the study of Quntum Chromodynamics (QCD) theory of the strong interaction between fundamental particles. The second is an irregular time evolution of a neural network; we discuss the general theory for arbitrary interconnects showing how different approaches are optimal as a function of the spareness and regularity of the networks. The generality of the hypercube for scientific computations is illustrated by its success on these very different problems. 27 refs.

13857 **(DOE/ER/25019—5) A variational principle for the Ackerberg-O'Malley resonance problem.** Srinivasan, R. (Washington Univ., Seattle (USA). Dept. of Applied Mathematics). Aug 1987. Contract FG06-86ER25019. 20p. (TR—87-7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004115/JAW.

A new variational principle is proposed for determining the asymptotic expansion of the solution of the Ackerberg-O'Malley resonance problem to any order in ϵ. The method used differs from that originally proposed by Grasman and Matkowsky in that variations are allowed in the boundary values of a transformed problem, making the calculation applicable to any order in ϵ. Explicit results using the new approach are reported to $O(\epsilon)$ and confirmed with asymptotic expansions of the exact solution. The $O(1)$ results agree with those reported in the literature, and the $O(\epsilon)$ results are new. It is not difficult to perform the higher order calculations using the new variational approach, in contrast to the current methods in use. In the case where the coefficient functions are analytic in the independent variable and ϵ, and the outer expansion satisfies a certain restriction, the exact solution presented provides an alternative and equally simple method for calculating the asymptotic expansion to any order in ϵ. 14 refs.

13858 **(DOE/ER/25026—17) Treating a single, stiff, second-order ODE directly.** Suleiman, M.; Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Dec 1987. Contract FG02-87ER25026. 39p. (UIUCDCS-R—87-1391; UILU-ENG—87-1781). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004193/JAW.

The stability of direct methods for second order systems is examined. The methods, suggested by Krogh, are generalized BDF methods. The control of step size to ensure stability is examined and criteria for deciding when to switch between methods are discussed. 5 refs., 7 figs., 4 tabs.

13859 (INIS-mf—11077, pp 183-204) **Remarks on the digital genration of artificial noise.** Behringer, K.; NIshihara, H.; Spiekerman, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). 1986. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88700819/JAW. (CONF-8504220—).

From 18. informal meeting on reactor noise; Prague, Czechoslovakia (10 Apr 1985).

The authors deal with the Fourier transform analysis for pattern recognition techniques as applied to power spectral density (PSD). They focus on the generation of the ergodic Gaussian random noise with arbitrarily given spectral characteristics. They study three methods of generation, viz.: 1. Digital filtering of white noise is not efficient for structured PSD and cannot be used for PSD with peaks. However, it gives good results in generating noise for flat PSD's. 2. Generation by modified Rice representation (1944/45) has the following properties: the generated noise shows excellent stationarity and normality; the PSD sampling statistics gives unsatisfactory results in simulating stochastic processes with largely structured PSD's; the generation is efficient, for a record of 1,024x10/sup 5/ data points it took about 8.5 minutes on a CDC 6000 computer. 3. Generation by Kac representation (1938) is mathematically interesting but unsuitable for practical applications. (A.K.) 13 figs.

13860 **(K—8412) A prototype system for the balancing of mass and energy in a potash circuit. Final report.** Madge, D. (Kilborn Ltd., Toronto (Canada)). Dec 1984. 71p. (MICROLOG—85-6075). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The results of a study on the development of a practical tool for the analysis of mass-flow and energy in a potash circuit is presented. The work has culminated in the development of a prototype microprocessor system capable of solving mass-energy balances and is demonstrated in the worse situation of a potash crystallizer for industrial circuits of major complexity. Contained within the report are specifications for hardware and software components that can be used to operate the application programs of the study. In this sense, the report is a user guide for researchers and plant designer. The general subject of process control is addressed from the standpoint of energy management along with some of the technical issues that retard progress in potash technology. The report discusses process control instrumentation and provides the specifications for an economical general purpose instrument for on-line mass-energy calculations to be used for process optimization.

13861 **(K/CSD/TM—76) Computer-Aided Design Information System (CADIS): User's manual.** Rosser, J.H.; Scott, G.W.; Schwarz, R.L. (ed.). (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Nov 1987. Contract AC05-84OT21400. 152p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88004365/JAW.

The Computer-Aided Design Information System (CADIS) is a computerized system whose purpose is to provide a resource management tool for Engineering managers responsible for the CAD systems used in designing and fabricating products and facilities at the Department of Energy's plants and laboratory operated by Martin Marietta Energy Systems, Inc., in Oak Ridge, Tennessee. CADIS collects, manages, and reports information useful in planning CAD system expansions and upgrades; budgeting and appropriation of funds; acquisition and installation of hardware and software components; allocation of manpower and equipment; and training of engineers, designers, and draftsmen in the use of CAD systems. This user's manual provides a review of CADIS's purpose, its database structure, and the specific information the database contains. Examples are given of available CADIS reports, and tutorials are presented for performing on-line input and retrieval of information from the database. 8 figs., 5 tabs.

13862 **(LA—11190-MS) On precision and accuracy (bias) statements for measurement procedures.** Bruckner, L.A.; Hume, M.W.; Delvin, W.L. (Los Alamos National Lab., NM (USA)). Jan 1988. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004434/JAW.

Measurement procedures are often required to contain precision and accuracy of precision and bias statements. This paper contains a glossary that explains various terms that often appear in these statements as well as an example illustrating such statements for a specific set of data. Precision and bias statements are shown to vary according to the conditions under which the data were collected. This paper emphasizes that the error model (an algebraic expression that describes how the various sources of variation affect the measurement) is an important consideration in the formation of precision and bias statements.

13863 **(LA-UR—87-3675) Status report on the ANSI [American National Standards Institute] 100-Mbyte/s channel.** Morrison, J.F. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 4p. (CONF-8709183—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88003183/JAW.

From Cray user group meeting; Bologna, Italy (22 Sep 1987).

Los Alamos National Laboratory has submitted to the American National Standards Institute (ANSI) committee a specification for a 100-Mbyte/s channel called the high-speed channel (HSC). This channel specification is a simple, yet high-performance, physical layer protocol and media definition. This report will describe the current definition of the HSC, possible applications, and status of our proposal before the ANSI committee. 2 figs.

13864 **(N—88-10563) Approximate polynomial preconditioning applied to biharmonic equations on vector supercomputers.** Wong, Y.S.; Jiang, H. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1987. 20p. (NASA-TM—100217; E—3826; NAS—1.15:100217). NTIS, PC A03/MF A01.

Applying a finite difference approximation to a biharmonic equation results in a very ill-conditioned system of equations. This paper examines the conjugate gradient method used in conjunction with the generalized and approximate polynomial preconditionings for solving such linear systems. An approximate polynomial preconditioning is introduced, and is shown to be more efficient than the generalized polynomial preconditionings. This new technique provides a simple but effective preconditioning polynomial, which is based on another coefficient matrix rather than the original matrix operator as commonly used.

13865 **(N—88-11402) Report from the MPP Working Group to the NASA Associate Administrator for Space Science and Applications. Technical memorandum report, 1 October 1985-30 September 1986.** Fischer, J.R.; Grosch, C.; Mcanulty, M.; Odonnell, J.; Storey, O. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1987. 64p. (NASA-TM—87819; REPT—87B0265; NAS—1.15:87819). NTIS, PC A04/MF A01.

NASA's Office of Space Science and Applications (OSSA) gave a select group of scientists the opportunity to test and implement their computational algorithms on the Massively Parallel Processor (MPP) located at Goddard Space Flight Center, beginning in late 1985. One year later, the Working Group presented its report, which addressed the following: algorithms, programming languages, architecture, programming environments, the way theory relates, and performance measured. The findings point to a number of demonstrated computational techniques for which the MPP architecture is ideally suited. For example, besides executing much faster on the MPP than on conventional computers, systolic VLSI simulation (where distances are short), lattice simulation, neural network simulation, and image problems were found to be easier to program on the MPP's architecture than on a CYBER 205 or even a VAX. The report also makes technical recommendations covering all aspects of MPP use, and recommendations concerning the future of the MPP and machines based on similar architectures, expansion of the Working Group, and study of the role of future parallel processors for space station, EOS, and the Great Observatories era.

13866 **(NUREG/CR—4862-Vol.1) Cognitive environment simulation: An artificial intelligence system for human performance assessment: Summary and overview: [Technical report, May 1986-June 1987].** Woods, D.D.; Roth, E.M.; Pople, H. Jr. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Nov 1987. 53p. NTIS, PC A04/MF A01 - GPO. Order Number TI88900189/JAW.

This report documents the results of Phase II of a three phase research program to develop and validate improved methods to model the cognitive behavior of nuclear power plant (NPP) personnel. In Phase II a dynamic simulation capability for modeling how people form intentions to act in NPP emergency situations was developed based on techniques from artificial intelligence. This modeling tool, Cognitive Environment Simulation or CES, simulates the cognitive processes that determine situation assessment and intention formation. It can be used to investigate analytically what situations and factors lead to intention failures, what actions follow from intention failures, the ability to recover from errors or additional machine failures, and the effects of changes in the NPP person-machine system. The Cognitive Reliability Assessment Technique (or CREATE) was also developed in Phase II to specify how CES can be used to enhance the measurement of the human contribution to risk in probabilistic risk assessment (PRA) studies. The results are reported in three self-contained volumes that describe the research from different perspectives. Volume 1 provides an overview of both CES and CREATE. 30 refs., 6 figs.

13867 **(ORNL/TM—10636) Combat modeling with partial differential equations.** Protopopescu, V.; Santoro, R.T.; Dockery, J.; Cox, R.L.; Barnes, J.M. (Oak Ridge National Lab., TN (USA)). Nov 1987. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88004764/JAW.

A new analytic model based on coupled nonlinear partial differential equations is proposed to describe the temporal and spatial evolution of opposing forces in combat. Analytic descriptions of combat have been developed previously using relatively simpler models based on ordinary differential equations (.e.g, Lanchester's equations of combat) that capture only the global temporal variation of the forces, but not their spatial movement (advance, retreat, flanking maneuver, etc.). The rationale for analytic models and, particularly, the motivation for the present model are reviewed. A detailed description of this model in terms of the mathematical equations together with the possible and plausible military interpretation are presented. Numerical solutions of the nonlinear differen-

tial equation model for a large variety of parameters (battlefield length, initial force ratios, initial spatial distribution of forces, boundary conditions, type of interaction, etc.) are implemented. The computational methods and computer programs are described and the results are given in tabular and graphic form. Where possible, the results are compared with the predictions given by the traditional Lanchester equations. Finally, a PC program is described that uses data downloaded from the mainframe computer for rapid analysis of the various combat scenarios. 11 refs., 10 figs., 5 tabs.

13868 **(PB—88-105499/XAB) Multiprocessor architectures for artificial-intelligence processing.** Delgado-Frias, J.G.; Moore, W.R. (Oxford Univ. (UK). Dept. of Engineering Science). Feb 1987. 28p. (OUEL—1671/87). NTIS, PC E05/MF E05.

This report presents several computer architectures for Artificial Intelligence applications in order to determine an AI application that may be suitable for a 2-D array architecture on WSI technology. Previous generations of computer systems have been variations of the same architecture: von Neumann style. A new generation is being developed, where a fundamental departure from the direction of the traditional digital computer systems has been focused. There are four major programs under way: the Japanese Icot program, the Espirit initiative in the EEC, the Alvey program in the UK, and the MCC and Darpa in the USA. The new generation of computer systems are based on parallel, distributed, and non-deterministic processing and symbolic manipulation. Artificial Intelligence applications play a key role in these systems; the interface between users and machine is performed by means of speech, natural languages, and pictures. The type of operations that the computer must execute are non-numeric (such as symbolic manipulation).

13869 **(PB—88-105960/XAB) Linguistic semantics for parallel computation.** Bertran-Salvans, M. (Rutherford Appleton Lab., Chilton (UK)). Apr 1987. 30p. (RAL—87-023). NTIS, PC E04/MF E04.

A model and a semantics for an extended grammar notation is given. The sentences of the language defined by the grammar correspond to a certain type of parallel composition of linear strings of values. They are refered to as data streams or simply streams. The notation can be used as a programming language involving procedures, parallelism, and multiple input-output but no communication; in a design stage where the internal communication among subsystems is of no concern. A version of it was used in the development of a computerized power network telecontrol system. Properties and laws of the semantic and syntactic domains are introduced, and some of them are informally proved. A set of transformation laws has been proved confluent with the help of a computerized equational reasoning system. Formal proofs of the properties of the model will be developed in the future with the help of the system.

13870 **(PB—88-853494/XAB) Supermicrocomputers. January 1975-November 1987 (citations from the INSPEC: information services for the Physics and Engineering Communities data base). Report for January 1975-November 1987.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 48p. NTISPC N01/MF N01.

Supersedes PB—86-850260.

This bibliography contains citations concerning the development and utilization of supermicrocomputers. Architecture analyses, market aspects, and descriptions of specific machines are among the topics considered. Some attention is given to networking aspects and operating systems. (This updated bibliography contains 107 citations, 41 of which are new entries to the previous edition.)

13871 **(SAND—86-8233) Calculating measurement imprecision and uncertainty.** Klevgard, P.A. (Sandia National Labs., Livermore, CA (USA)). Nov 1987. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88003981/JAW.

This study is intended to act as a guide in the application of certain statistical techniques to typical test data. A tutorial approach is employed, with specific examples illustrating all of the calculations required for both random uncertainty and systematic uncertainty. Three different situations are covered: multiple data values that apply to but a single test point and require a single uncertainty value; multiple data values over a variety of test points with individual uncertainty values applying to the individual test points; and multiple data values over a variety of test points with a single, pooled uncertainty value applying to all the test points. 4 figs., 2 tabs.

13872 **(SAND—87-1414) CUEMAP: A tool for generating hierarchical charts and dataflow diagrams.** Lee, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1987. Contract AC04-76DP00789. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88004778/JAW.

CUEMAP is a preprocessor to the MAPPER program, which generates report quality visual aids. CUEMAP uses text blocks, symbols, and line connectors to lay out hierarchical charts and dataflow diagrams. A grid is specified as a reference point on which the labels and symbols can be placed. Connectors are added to complete the diagram. Modifications and enhancements require knowledge of the MAPPER syntax. 1 ref., 2 figs.

13873 **(SAND—87-1551C) A component synthesis method using Lanczos vectors.** Allen, J.J. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 24p. (CONF-880220—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002263/JAW.

From 6. international modal analysis conference; Orlando, FL, USA (1 Feb 1988).

A component synthesis technique has been developed, which uses a combination of constraint modes and fixed interface Lanczos vectors. The sequence of Lanczos vectors are obtained via a recursion equation similar to inverse iteration and mass orthonormalized to the previously derived vectors. The static solution of a problem of interest or a set of random vectors can be used as the initial Lanczos vector in the sequence. The fixed interface Lanczos method produces a statically complete model for a given load, if the static solution is the first vector in the sequence. The subsequent Lanczos vectors, X/sub i/, in the sequence can be interpreted as being generated using the dynamic error, K/sup -1/MX/sub i-1/, of the previous vector. Including constraint modes for the boundary degrees of freedom retains physical degrees of freedom for the boundary, which allows the component to be incorporatd into the system by direct matrix assembly. The convergence characteristics of the fixed interface Lanczos method is studied using static and transient analysis. Various criteria are examined for evaluating the convergence. The results of the fixed interface Lanczos method will be compared to the component mode synthesis method developed by Hurty. 13 refs., 7 figs., 4 tabs.

13874 **(SLAC-PUB—4414) High performance data buses: Progress and evolution.** Gustavson, D.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1987. Contract AC03-76SF00515. 4p. (CONF-871006—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88002570/JAW.

From Nuclear science symposium; San Francisco, CA, USA (21 Oct 1987).

In 1987 four new 32-bit computer backplane buses joined Fastbus as IEEE standards. They are Futurebus, VME, NuBus, and Multibus-II. This paper compares and contrasts these buses, discusses their strengths and weaknesses, and considers possible directions for future improvement. Some of these buses have reached fundamental limits. How can they be improved? Can they be extended in ways which are backward compatible with present buses, or will they be abandoned in favor of new designs? What direction will new bus designs take. 4 refs.

13875 **(SOL—87-14) Eliminating columns in the simplex method for linear programming.** Ye, Yinyu. (Stanford Univ., CA (USA). Systems Optimization Lab.). Nov 1987. Contract FG03-87ER25028. 14p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88004191/JAW.

In this paper we pose and answer two questions about solutions of the linear complementarity problem (LCP). The first question is concerned with the conditions on a square matrix M which

guarantee that for every vector q, the solutions of LCP (q,M) are identical to the Karush-Kuhn-Tucker points of the natural quadratic program associated with (q,M). In answering this question we introduce the class of "row sufficient" matrices. The transpose of such a matrix is what we call "column sufficient." The latter matrices turn out to furnish the answer to our second question which asks for the conditions on M under which the solution set of (q,M) is convex for every q. In addition to these two main results, we discuss the connections of these two new matrix classes with other well-known matrix classes in linear complementarity theory. 23 refs.

13876 (TES—C204/1) Pilot hydrocracking online information logging (PHOIL) system software. (TES Ltd., Ottawa, Ontario (Canada)). May 1979. 109p. (MICROLOG—86-01199). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

During operation of hydrocracking plants, a number of sensors (thermocouples, pressure transducers, etc.) continuously monitor the state of the plants, rates of flow, and other variables. In order to analyse the results of experiments on the processes used, it is desirable to record the outputs of these sensors for later study. This report describes calculator software developed by TES Ltd. for CANMET to acquire data during operation of two pilot hydrocracking plants. Chapter 3 of the report provides an overview of the system and describes the contents and layout of the system operation tape and the format of the data tapes. Chapter 4 contains descriptions, flow charts, and source listings of each program. Chapter 5 contains notes on interfacing between the datalogger and calculator. Chapter 6 contains notes, flow charts, and source listings for separate programs that retrieve data from the data tapes and plot it. These latter programs are provided on a separate tape.

13877 (UCID—21278) Conversion of data for Nevada Test Site. Koide, G. (Lawrence Livermore National Lab., CA (USA)). 6 Aug 1987. Contract W-7405-ENG-48. 14p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE88004372/JAW.

The data acquisition system of the High Pressure Test Facility stores information on 8.45 inch floppy disks in a binary format. Each record consists of time, occupying two integer words, and data, consisting of integer words which represent the number of counts from a twelve-bit analog-to-digital converter. The Nevada Test Site (NTS) data acquisition system uses a similar record structure, time and data, but stores a file in an ASCII format. This paper describes a translation program that converts the binary files of several systems tested at the High Pressure Test Facility to an ASCII file for use at NTS. 2 figs.

13878 (UCRL—53828) A fast bottom-up algorithm for computing the cut sets of noncoherent fault trees. Corynen, G.C. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 60p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE88003741/JAW.

An efficient procedure for finding the cut sets of large fault trees has been developed. Designed to address coherent or noncoherent systems, dependent events, shared or common-cause events, the method - called SHORTCUT - is based on a fast algorithm for transforming a noncoherent tree into a quasi-coherent tree (COHERE), and on a new algorithm for reducing cut sets (SUBSET). To assure sufficient clarity and precision, the procedure is discussed in the language of simple sets, which is also developed in this report. Although the new method has not yet been fully implemented on the computer, we report theoretical worst-case estimates of its computational complexity. 12 refs., 10 figs.

13879 (UCRL—53832) Graph transformation algorithms for array memory optimization in applicative languages. Ranelletti, J.E. (Lawrence Livermore National Lab., CA (USA)). Nov 1987. Contract W-7405-ENG-48. 221p. NTIS, PC A10/MF A01; GPO Dep. Order Number DE88004727/JAW.

In applicative language implementations, the potential copying of array elements can severely restrict the efficiency of the run-time code. In many instances, copy avoidance can be achieved through memory preallocation. This Ph.D. dissertation presents a compile-time graph algorithm strategy, for use with the SISAL programming language, that identifies cases where preallocating memory storage locations for array aggregates is possible. The preallocation actions to be taken are specified by providing intermediate language graph transformations that designate the run-time creation of memory buffers prior to array creation. The preallocation analysis algorithms predict a significant savings in the execution time of selected sample programs; more than 90% of the array copying operations can be removed from existing unoptimized implementations. The results indicate that array memory allocation for some applicative language programs can be efficient. 93 refs., 58 figs., 6 tabs.

13880 (Y/CSD/INF—87/1) A raster scan algorithm for generating visible parametric surfaces. Akin, J.E.; Gray, W.H. (Rice Univ., Houston, TX (USA); Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 5p. (CONF-8708192—1). NTIS, PC A02. Order Number DE88003222/JAW.

From Computers in mechanical engineering; Orlando, FL, USA (1 Aug 1987).

Finite element analyses and computer aided design systems must often present graphical representations of three-dimensional parametric surfaces. Various algorithms have been developed to describe color surfaces and to determine visibility. A procedure for using parametric interpolation to define such surfaces is presented. It is an extension of an earlier algorithm for defining contour lines on such surfaces. When applied on a raster scan color graphics device (or a line printer) the procedure allows the true representation of parametric surfaces. Surfaces can be presented in different colors. The intersection of surfaces is automatically included in the procedure for determining visibility. The algorithm can also be easily extended to allow color contour shading of values on the surface. 8 refs., 10 figs.

13881 Evaluation of effectiveness of circuit based and packet based interconnection networks via petri net models. Adiga, A.K.; Deshpande, S.R. (Departments of Computer Sciences, Univ. of Texas at Austin, Austin, TX 78712). pp 533-541 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

This paper illustrates the modelling of an interconnection network based multiprocessor system using an extended Petri Net basis. Petri Nets have been used in the past to model high level large granularity processes. The model described here can be used to simulate both high level processes and the low level functional behavior of an interconnection network. Models and performance results are presented to circuit and packet switched implementations of shared memory systems.

13882 PSolve: A concurrent algorithm for solving sparse systems of linear equations. Davis, T.A.; Davidson, E.S. (Center for Supercomputing Research and Development, Univ. of Illinois, 104 S. Wright Street, Urbana, IL 61801). pp 483-490 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

PSolve solves a sparse system of linear equations on a shared-memory parallel processor. Each autonomous process reduces a pair of matrix rows, uses pairwise pivoting for numerical stability, and synchronizes with only a few others at a time. For most test matrices, on the Alliant FX/8 multiprocessor, PSolve is faster than Guassian Elimination (does not exploit sparsity) and the Yale Sparse Matrix Package (does not exploit parallelism). Although Gaussian Elimination runs in vector mode, PSolve cannot use currently available vector hardware because of it compact matrix storage scheme. However, with a new "sparse-align vector

unit, PSolve is vectorizable and runs faster than any other algorithm for all the selected test matrices.

13883 **Debugging fortran on a shared memory machine.** Allen, T.R.; Padua, D.A. (Center for Supercomputing Research and Development, Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801). pp 721-727 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Debugging on a parallel processor is more difficult than debugging on a serial machine because errors in a parallel program may introduce nondeterminism. The approach to parallel debugging presented here attempts to reduce the problem of debugging on a parallel machine to that of debugging on a serial machine by automatically detecting nondeterminism.

13884 **The Lambda network: A new permutation network.** Lee, D. (Center for Supercomputing Research and Development, Univ. of Illinois, 305 Talbot, 104 S. Wright Street, Urbana, IL 61801). pp 407-410 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

A new permutation network, called the Λ network is presented. The Λ network which is based on the Batcher sorter, passes arbitrary permutations under a local single bit control. The network is highly modular, and suitable for a pipelined, packet-switching operation. The construction of the Λ network illustrates an approach by which a permutation network can be obtained from a sorting network. Also the basic idea of deriving a new multistage interconnection network from a permutation network is discussed, together with some aspects of the application of the Λ network as an interconnection network for a parallel supercomputer.

13885 **Environments for prototyping parallel algorithms.** Purtilo, J.; Reed, D.A.; Grunwald, D.C. (Dept. of Computer Science, Univ. of Maryland, College Park, MD 20742). pp 431-438 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

The current ferment in parallel computer architecture has exacerbated the already large problems in developing and testing parallel algorithms. Although only experimentation will identify effective designs, the variety of computing paradigms has precluded development of the (necessary) general environment for parallel programming. The authors propose an environment design system where design specification is divorced from implementation. Because the design system, Polylith, provides the communication structure of a parallel computation, the computation's individual tasks can be written in one of several relatively portable sequential languages.

13886 **Parallel garbage collection on a virtual memory system.** Abraham, S.G.; Patel, J.H. (Center for Supercomputing R and D, Univ. of Illinois, Urbana, IL 61801). pp 243-246 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Since most artificial intelligence applications are programmed in list processing languages, it is important to design architectures to support efficient garbage collection. This paper presents an architecture and an associated algorithm for parallel garbage collection on a virtual memory system. Unlike other parallel algorithms, the collector reclaims storage from an earlier unchanging version of the list structure and not the version currently being modified by the list processor. Furthermore, the proposed algorithm is designed for virtual memory systems where both the list processor and the garbage collector have private memories. The enforcement of coherence between the two private memories can be expensive and is not necessary in this scheme.

13887 **Loop coalescing: A compiler transformation for parallel machines.** Polychronopoulos, C.D. (Center for Supercomputing Research and Development, and Dept. of Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801). pp 235-242 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

In this paper the authors discuss a compiler transformation called loop coalescing which can be used to reduce run-time overhead and simplify the loop scheduling problem. Parallel loops account for the greatest amount of parallelism in numerical programs. Executing nested loops in parallel with low run-time overhead is thus very important for achieving high performance on parallel computers. Loop coalescing is a restructuring technique that transforms several types of nested parallel loops into a single loop. As a result of this transformation the loop scheduling problem becomes simple. Moreover the amount of synchronization (i.e., run-time overhead) associated with the parallel execution of loops is reduced sharply through loop coalescing. Several examples are presented and the general transformation is discussed in detail. They also give an example of application of loop coalescing to loop scheduling.

13888 **Simultaneous update of priority structures.** Biswas, J.; Browne, J.C. (Dept. of Computer Science, The Univ. of Texas at Austin, Austin, TX 78712-1060). pp 124-131 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

To avoid centralized bottlenecks, data structures for multiple computer systems must be simultaneously updatable and yet must have some coherent and consistent state. This can be achieved through judicious partitioning of system data structures and control of access to them in such a manner that i) either different processes operate upon disjoint segments of a given structure; or ii) processes operate upon the same datum object, in a controlled manner. Partitioning of data structures can be by structure or content. It can also occur at multiple times. In this paper the authors demonstrate content partitioning of a κ-ary tree data structure at runtime, to realize a simultaneously updatable priority queue. The tree algorithms are then generalized to banyan data structures and shown to possess attractive properties of simultaneous update and throughput.

13889 **Parallel access to synchronization variables.** Jayasimha, D.N. (Center for Supercomputing Research and Development, Univ. of Illinois, Urbana, IL 61801). pp 97-100 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

The following synchronization problem occurs in parallel processing: a set of n processes need to begin execution of their next tasks only after every process has completed its current task. Such a barrier synchronization is usually implemented by shared variable(s) in tightly coupled multiprocessor. The authors define the completion time as the earliest time when every process knows that all other processes have completed. They develop analytical models using Markov chains to estimate the effects of barrier synchronization on the completion time of processes. Three algorithms are given to implement barrier synchronization and completion time expressions are derived for these implementations. The relative merits of the three schemes are compared. Two schemes require O(nlogn) accesses as opposed to 2n-1, the idealized number of accesses. The third scheme which is difficult to implement has a linear growth in the number of accesses (approx. 4n).

13890 **Data prefetching in shared memory multiprocessors.** Lee, R.L.; Yew, P.C.; Lawrie, D.H. (Center for Supercomputing Research and Development, Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801). pp 28-31 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

The trace driven simulation of 16 numerical subroutines is used to compare instruction lookahead and data prefetching with private caches in shared memory multiprocessors with hundreds or thousands of processors and memory modules interconnected with a pipelined network. These multiprocessors are characterized by long memory access delays that create a memory access bottleneck. Using the multiprocessor cache model from [LeYL87] for comparison, data prefetching is found to be more effective than caches in addressing the memory access bottleneck.

13891 **Deadlock prevention in processor self-scheduling for parallel nested loops.** Tang, P.; Yew, P.C.; Fang, Z.; Zhu, C.Q. (Center for Supercomputing, Research and Development, Univ. of Illinois, Urbana, IL 61801). pp 11-18 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

Processor self-scheduling is an effective distributed dynamic scheduling scheme for parallel nested loops in multiprocessor systems. A parallel nested loop structure can be considered as a task system. A task is an iteration (or several iterations) of an innermost loop body and the execution order of tasks is determined by a precedence relation. Data dependences among statements are enforced either by the precedence relation or by explicit synchronization. Since self-scheduling is non-preemptive and uses busy-waiting as the basic technique for task synchronization, deadlocks may possible arise. This paper identifies conditions that allow deadlock-free processor self-scheduling. It uses control tokens and data tokens to model the precedence relation and data dependences. Both control tokens and data tokens, together with processors, are regarded as three kinds of resources needed by tasks. Based on this resource model, the authors study three possible self-scheduling schemes with different degrees of parallelism, and propose to use a appropriate scheduling priority for allocating processors to prevent deadlocks.

13892 **Dynamic processor self-scheduling for general parallel nested loops.** Fang, Z.; Yew, P.C.; Tang, P.; Zhu, C.Q. (Dept. of Computer Science, Wichita State Univ., Wichita, KS). pp 1-10 of Proceedings of the 1987 international conference on parrallel processing. Sahni, S.K. University Park, PA; Pennsylvania State University (1987). (CONF-870831—).

From International conference on parallel processing; St. Charles, IL, USA (17 Aug 1987).

In this paper the authors present a complete dynamic processor self-scheduling approach for general nested loops. General nested loops contain both parallel and serial loops and the execution time of their iterations can vary widely. In this scheme, an instance of the innermost loop is considered to be the basic unit in a precedence graph. An instance is said to be active if the instance is ready to be executed. Completion of an instance will activate instances of other innermost loops. The basic concept in the scheme is to keep all processors busy as long as there exists any active instance. By effectively using synchronization primitives provided in a parallel processing system, the overhead of the approach can be significantly reduced. They also present the data structure needed to represent a general nested loop in our self-scheduling scheme.

13893 **Replicated state space approach for parallel simulation.** Gilmer, J.B. Jr.; Hong, J.P. (The BDM Corp., 7915 Jones Branch Drive, McLean, VA 22102). pp 430-434 of The 1986 winter simulation conference proceedings. Wilson, J.R.; Henriksen, J.O.; Roberts, S.D. Chicago, IL; Institute of Gas Technology (1986). (CONF-861218—).

From Winter simulation conference; Washington, DC, USA (8 Dec 1986).

Parallel processing offers the possibility of greatly increased performance for simulation which are computationally bound on existing machines. On shared memory machines, such as the BBN Butterfly, a natural approach is to allocate entities to be processed on different processors with locks used to prevent synchronization problems for a state space in global memory. Parallel processors having local memory only, such as the hypercube architectures, cannot use this approach. Such machines are potentially less expensive than shared memory architectures with similar local computational power, since the interconnection network is simpler. The most natural simulation paradigm for such machines, object oriented programming with interactions limited to messages, may become communications bound if the entities represented are tightly coupled. This paper presents an alternative approach based on use of replicated state spaces on each processor, and consolidation of these changes on a processor basis rather than an interaction basis to minimize message passing. The effect is to trade a parallel processing synchronization problem for a data consistency problem. The approach then relies only on a message broadcasting or passing architecture. For small degrees of parallelism, this requirement can be met by a variety of architectures. The method described is being applied to parallelize the CORBAN combat simulation for operation on a hypercube architecture as part of preliminary feasibility analysis concerning simulation support of AirLand Battle Management (ALBM).

13894 **An expert system for USNRC emergency response.** Sebo, D.E.; Bray, M.A.; King, M.A. (EG and G Idaho, Inc., Idaho Falls, ID). pp 74-79 of Proceedings of expert systems in government symposium. Karna, K.N.; Parsaye, K.; Silverman, B.G. Piscataway, NJ; IEEE Service Center (1986). (CONF-8610145—).

From 2. expert systems in government conference; McLean, VA, USA (20 Oct 1986).

The Reactor Safety Assessment System (RSAS) is an expert system under development for the United States Nuclear Regulatory Commission (USNRC). RSAS is intended for use at the NRO's Operations Center in the event of a serious incident at a licensed nuclear power plant. RSAS is a situation assessment expert system which uses plant parametric data to generate conclusions for use by the NRC Reactor Safety Team. RSAS uses multiple rule bases and plant specific setpoint files in order to be applicable to all licensed power plants. RSAS currently covers several generic reactor types and power plants within those classes.

13895 **Online computer farms configurations and capabilities.** Fortney, L.R. (Duke Univ., Durham, NC). pp 232-243 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

If the possibility of the four-vector approach is to be preserved, the online facility should receive a large share of available computing resources. Because of the inherent bandwidth limitations of any long distance communication link, this argument favors the allocation of major computing resources to each intersection region (IR). Since online and offline event processing strategies both favor the high bandwidth farm architecture, an IR computing complex consisting of several levels of locally connected processor farms of varying capability would provide the most flexible arrangement of computing power per dollar. For such a scheme to be successful, considerable effort must be expended on the operating system driving the farms. If this is sufficiently evolved, the farms appear capable of handling all experimental computing jobs with the exception of the rapid thru put of a single event.

13896 **Modelling microprocessor farms for SSC data acquisition.** Cutts, D.; Van Ingen, C. (Brown Univ., Providence, RI). pp 216-221 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

Data acquisition, involving both data collection and accompanying filtering, is a crucial part of an SSC experiment. Modelling is a valuable and perhaps necessary tool for a successful design of such complex systems. As a demonstration of the modelling process the authors made a few studies of simple systems consisting of a large number of microprocessors arranged in a "farm," a system in which each event is routed from the digitization/readout crates directly to a single microprocessor, one of a large parallel array, which performs the complete software event filter on that event. Subsequent events are transferred in turn to other processor nodes which are idle. The results of their crude simulations agree with the expected performance of such farms, and suggest that realistic modelling of SSC acquisitions will be important.

13897 **Data rates for event builders and processor farms.** Devlin, T. (Dept. of Physics and Astronomy, Rutgers - The State Univ. of New Jersey, P.O. Box 849, Piscataway, NJ 08854). pp 244-250 of Proceedings of the workshop on triggering, data acquisition and computing for high energy, high luminosity, hadron-hadron colliders. Cox, B.; Fenney, R.; Hale, P. Batavia, IL; Fermi National Accelerator Laboratory (1985). (CONF-8511150—).

From Workshop on triggering, data acquisition and computing for high energy/high luminosity hadron-hadron colliders; Batavia, IL, USA (11 Nov 1985).

The author finds it educational to perform a very naive calculation of data rates through a matrix of event builders and a processor farm with the architecture currently popular amongst devotees of this subject. He has doubt that sophisticated use of queuing algorithms such as RESQ will yield a much more precise picture of such a data pieipline. Nevertheless, there may be others out there who feel more comfortable with a simple numerical/algebraic picture of these multi-Gigabyte data rates.

9903 Information Handling

REFER ALSO TO CITATION(S) 10974, 11022, 12422, 13147, 13861

13898 **(AD-A—185177/3/XAB) Storing and retrieving data in a parallel distributed-memory system. Doctoral thesis.** Potter, T.W. (Brown Univ., Providence, RI (USA). Center for Neural Science). 9 Jun 1987. 11p. NTIS, PC A03/MF A01.

The storage and retrieval of patterns in a Hopfield-like Parallel Distributed Memory is investigated experimentally with a view toward increasing its storage capacity. The first two Chapters give an overview of distributed memories and, in particular, the Hopfield distributed memory. This dissertation then experimentally investigates new and untested methods to increase the storage capabilities of a Hopfield-like neural net. Increasing the storage capacity by using the continuous-valued Hopfield memory is explored in Chapter 3 and the impact on capacity of data representation is experimentally investigated in Chapter 4. New ways of storing data are then discussed (changing the interconnect strengths) including in Chapter 7 developing a new method called Modifying the Energy Contour or MEC. In addition, this Chapter also outlines how to increase error-tolerance through the use of noisy patterns. The Hopfield distributed memory is then contrasted to another intelligent memory subsystem based on more of a traditional computer technology. In Chapter 8 it is seen that traditional computer technology using data-parallel techniques has a greater storage efficiency than possible with current Hopfield-like distributed memories.

13899 **(CFER—8511) Networking programs for Arctic and offshore energy development. Phase 1. Progress report.** Staples, L.B.; Adams, P.F. (Centre for Frontier Engineering Research, Edmonton, Alberta (Canada)). Nov 1985. 69p. (MICROLOG—86-01201). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. PC $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The Centre for Frontier Engineering Research (C-FER) was established to work on problems related to offshore structures and downhole tubular systems. Strong support was also evident for technology transfer activities; C-FER was therefore in charge of research plus networking. This report summarizes networking activities in the first half of the initial three year period and presents proposed plans for the following eighteen months. The program of face-to-face industry contacts has been effective. A suite of newsletters has been developed to supplement this direct contact. These are well received and are a useful tool for information dissemination. Several workshops have been run in which participants shared common problems and solutions. Other activities discussed include: the development of a research reporting system, the establishment of a "C-FER Atlantic" operation in Halifax, and the preparation of a state-of-the-industry overview. Indications to date are that the C-FER Network is useful to its constituent contacts. However, C-FER must continue to listen closely to its Network clients in order to identify and meet their needs.

13900 **(INS-T—467) Intelligent buffer module. Speed up of CAMAC system.** Ikeda, M.; Ukai, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1987. 30p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88751431/JAW.

A start of data taking using the CAMAC system is usually triggered by the LAM(Look at Me) signal from a module. A host computer processes a LAM interruption and issues a CAMAC I/O operation in order to read in the data from modules and handles an I/O completion interruption after the data read in process. If a data has a complex structure, plural I/O operations must be issued. For example, a usual CAMAC system consists of many repeat mode and address scan mode modules. These LAM interruption, I/O operation and completion operation need a time of a few msec. Then, a frequency of the data taking is limited about 100 Hz in the ordinary CAMAC system using a LAM interruption. In order to increase the data taking frequency by reducing LAM, I/O operations and completion interruption, an intelligentbuffer module (IB) is designed to reduce a frequency of LAM, I/O operations and completion interruptions. The IB is set in a crate and performs hundreds times of data buffering.

13901 **(INS-T—470) Network system at INS.** Chiba, K.; Oshikubo, T.; Shinohara, M.; Takano, M.; Ukai, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1987. 22p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88751433/JAW.

The INS (Institute for Nuclear Study) computer system consists of two large general purpose computers(FACOM M-380, M-200), two super mini-computers(FACOM S-3500) and three mini-computers(PANAFACOM U-400). The on-line real time system for experiments using accelerators at INS is constructed by M-200, S-3500 and U-400 computers. U-400 is directly coupled with the M-200 by a channel to channel connection method and S-3500 is connected by an optical fiber method called as a flexible system link. To improve the utility of the M-380 system, a small LAN (Local Area Network) system was constructed and completed at December in 1986. About 60 users can connect with their own personal computers by a RS-232C cable to this LAN with a speed of 9600 baud. Communication to the M-380 from outside the institute became possible as of November using a DDX-packet Network (Japanese commercial X.25 lines supported by the NTT Ltd.). Some useful softwares for using LAN and DDX are developed and installed by the computer room. These softwares are a TSS terminal emulator program, a file transfer program, mail and board systems. In this report, hardware of this network, usage and connection to this system and available softwares are described.

13902 **(NUREG/CR—4690-Vol.2) Generic communications index: User's manual.** Dean, R.S.; Steinbrecher, D.H.; Hennick, A. (Parameter, Inc., Elm Grove, WI (USA)). Dec 1987. 16p. NTIS, PC A03/MF A01 - GPO. Order Number TI88900253/JAW.

This report is a manual for providing information required to use a special computer program developed by the NRC for indexing generic communications. The program is written in a user-friendly menu driven form using dBASE III programming language. It facilitates use of the required dBASE III search and sort capabilities to access records in a database called Generic Communications Index. This index is made up of one record each for all bulletins, circulars, and information notices, including revisions and supplements, from 1971, when such documentation started, through 1986 (or to the latest update). The program is designed for use by anyone modestly acquainted with the general use of IBM-compatible personal computers. The manual contains both a brief overview and a detailed description of the program, as well as detailed instructions for getting started using the program on a personal computer with either a two-floppy disk or a hard disk system. Included at the end are a brief description of how to handle problems which might occur, and notes on the makeup of the program and database files for help in adding records of communications for future years.

13903 **(PB—88-105283/XAB) Model for dynamically structured communicating systems. Technical report series.** Hopkins, R.P.; Koutny, M. (Newcastle upon Tyne Univ. (UK). Computing Lab.). 1987. 44p. (TR-SER—239). NTIS, PC E04/MF E04.

The authors here develop a model of structure and communication within systems of concurrently executing components connected by asynchronous communication links, and formulate a definition of observational equivalence between systems. The most important aspect of the model is that it accomodates the dynamic system connectivity required to model open and continuously operating systems, by allowing creation of new communication links and allowing an end-point of a communication link to be communicated as part of a message, with the recipient thus dynamically acquiring the ability to communicate on that link. For the model, the authors formulate a novel definition of observational equivalence in terms of equivalent operational behaviors of possible observing systems.

13904 **(PB—88-853312/XAB) Digital communication systems: interference. July 1983-November 1987 (citations from the Engineering Index data base). Report for July 1983-November 1087.** (National Technical Information Service, Springfield, VA (USA)). Dec 1987. 100p. NTISPC N01/MF N01.

Supersedes PB—86-869179.

This bibliography contains citations concerning interference analysis of digital communication systems. Topics include digital and radio transmission systems, signal interference and noise, bit error rate, phase-shift keying, and pulse code modulation. Interference and noise immunity, fading multipath environments, error probability, error-rate monitoring techniques, pulse and quantization noise, radio telephone, and mobile radio systems are discussed. (This updated bibliography contains 224 citations, 83 of which are new entries to the previous edition.)

13905 **(PSD—87, pp M4) Automatic system for storage and search of annihilation data.** Abdurasulev, Z.R.; Zhuravleva, G.I.; Malyan, V.M. (AN Uzbekskoj SSR, Tashkent. Inst. Ehlektroniki). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE87703128/JAW. (CONF-8703162—).

From European meeting on positron studies of defects; Wernigerode, German D.R. (23 Mar 1987).